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AUTHOR Davis, Richard M.
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ABSTRACT

The survey reported in this document was undertaken to determine the experience and opinions concerning written technical communications of prominent and successful engineers in a wide variety of engineering fields. A questionnaire sent to 245 engineers asked 11 specific questions, 8 of which dealt with the respondents' own experiences and the writing necessary in their positions (the amount done, its importance, and its effect on their own and others' advancement) and 3 of which dealt with the respondents' opinions about courses in technical writing in scientific and engineering curricula. Replies were received from 73.6 percent of those surveyed and indicated that respondents spend 24 percent of their time writing, the writing is very important to their positions, and the ability to write effectively has helped them in their own advancement. In addition, 80.5 percent feel that technical writing (clear, direct, and logically developed) should be required of all engineering students, while 16 percent feel it should be an elective course. (JM)

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TECHNICAL WRITING: ITS IMPORTANCE IN THE ENGINEERING PROFESSION AND ITS PLACE IN ENGINEERING CURRICULA - A SURVEY OF THE EXPERIENCE AND OPINIONS OF PROMINENT ENGINEERS

This document has been approved for public release and sale; its distribution is unlimited.

by

RICHARD M. DAVIS
Professor of English
Department of Humanities
Air Force Institute of Technology

CS 202 427

PREFACE

This report presents the results of a survey of professional opinion on the importance of technical writing in the engineering profession and its place in the engineering curriculum. Very sincere thanks are due the 245 prominent engineers who gave of their time in answering the survey questions, and special acknowledgment is in order for the many additional comments these gentlemen took the time to include. The insights provided into the experience and the thinking of experienced and successful practitioners should be invaluable to curriculum planners, to teachers of technical writing, and to students alike.

Special acknowledgment is due Mrs. Joyce Barnes for her willing assistance in the preparation of the questionnaires used in the survey, the tabulation of responses received, and the preparation of this report.

Richard M. Davis

Contents

I	Introduction	1
II	Procedure	2
III	Results	9
IV	Summary	18
Appendix A	Comments on the Desired Result of a Course in Technical Writing	21
Appendix B	General Comment by Respondents	46

Abstract

A questionnaire was sent to prominent successful engineers to determine their experience with technical writing, their opinions about its importance to an engineer, and their opinions about its place in the engineering curriculum. A surprising 73.8 percent (245 of those surveyed) responded. The replies indicate that the respondents spend 24 percent of their time writing, that the writing that they do is very important to their positions, and that the ability to write effectively has helped them in their own advancement. They spend 31 percent of their time working with material written by others, are acutely conscious of the need for effective written communications, and find fault with many of the written communications with which they deal. They indicate that the ability to write is usually important or critical when a man is considered for advancement.

80.5 percent of the respondents feel that technical writing should be required of all engineering students and 16 percent feel that it should be an elective with all students encouraged to take it. They feel that the main emphasis in such courses should be on teaching students to analyze a writing situation and produce a clear, direct, logically developed communication to meet the reader's needs without burdening him with extraneous material or long-winded verbiage. Special emphasis should be placed on the need for clarity and ready comprehensibility.

I Introduction

As industry, government and business have become larger and their operations more complex, as products and services provided have become more diverse and subject to change, and as scientific and technological advancement have come at an increasing pace, the quantity and importance of written technical communications have increased in seemingly geometric progression. More and more writing is done by more and more people on more and more subjects. And the recipients of the communications are more and more dependent upon their accuracy and effectiveness.

Some recognition of this condition is reflected in technical schools by the inclusion of courses in technical writing in many engineering curricula. But it is at least questionable whether all of the faculty concerned fully recognize the amount of writing that a working engineer or manager must do or the importance to him (and to his performance of his job) that it be done easily and effectively. Many faculty members, though fully competent in their own fields, simply have not had extensive experience with the realities of the life of a practicing engineer or manager.

The survey reported here was undertaken to determine the experience and the opinions of a group of prominent, successful and experienced engineers in a wide variety of engineering fields with respect to written technical communications. The intention was to find out how much writing they actually do, how important it is in their positions, how much of their time is spent working with materials that others have written, and how important the ability to write effectively might be to someone who was being considered for advancement. Beyond this, their opinions on the desirability of courses in technical writing in engineering curricula and their ideas about the content of such courses were solicited.

The results of the survey should be of interest to curriculum planners in scientific and engineering schools, to the faculty members who structure and teach courses in technical writing (by whatever name it may be known), and to the students themselves.

II Procedure

The data and comments reported were gathered through a mail survey of the opinions and experience of a substantial group of prominent and respected practitioners in a wide variety of engineering disciplines. The questionnaire used and the compilation of the list of recipients were simple and direct.

Questionnaire

As the people to be surveyed were busy engineers and executives with many demands on their time and little to gain by responding to the survey, the questionnaire was kept short and the process of answering simple in the hope of eliciting the greatest possible return. The questions themselves were short and the form of the answers such that clear-cut differentiations could be made with a minimum of subjective judgment in the interpretation of the responses.

Eleven specific questions were asked, and space was provided for any comment the respondent might wish to make. Eight of the questions concerned the respondent's own experience and the writing (and use of material written by others required) in his position -- the amount done, its importance, its effect on his own advancement and that of others. Three questions concerned the respondent's opinions about courses in technical writing in scientific and engineering curricula -- whether they should be included, what they should contain, and what the end result should be. Seven of the questions were multiple-choice questions, two required percentage estimates, one required a simple number (years of experience), and only one called for a structured response. The questionnaire is included on pages 5-7.

Letter of Transmittal

Each questionnaire was sent with a form letter of transmittal which was reproduced in quantity. Names of recipients were individually typed on the letters, and each letter was individually signed. The letters did not suggest an opinion either favorable or unfavorable to the inclusion of

technical writing in the engineering curriculum, and the signature block indicated only that I am on the faculty of the School of Engineering -- not that I teach technical writing. The form used is shown on page 8.

Population Polled

The intention was to survey successful and experienced engineers in a wide variety of engineering fields. To this end, names were selected from the 1973 edition of Engineers of Distinction: A Who's Who in Engineering, published by the Engineers' Joint Council. The 14 Member Societies and 21 Associate Societies comprising the Council represent a very substantial cross section of the engineering profession. Specific criteria for inclusion in Engineers of Distinction are listed on page ii of that volume.

The first name listed on each page of the main listing was used in the survey with the following exceptions:

1. Faculty members and academic administrators. The intention of the survey was to determine the experience and opinions of practitioners, managers, and executives with substantial engineering experience.

2. Persons listed as living outside the United States. These people were omitted because of the likelihood that their response time would be greater than that of people living in the United States. (This judgment was probably correct. A few of the returns came from people who had moved to overseas positions since publication of the list, and they were generally the last ones received. The final return came from Thailand.)

3. Persons listed as members of the armed forces of the United States. Had they been included, it might appear to some readers that their responses would in some way be biased because the survey was conducted by a member of the faculty of an Air Force school. Despite this attempted precaution, four Generals and one Admiral received questionnaires and replied. Their responses are included in the results.

Where the first name listed on a given page of Engineers of Distinction was a member of one of these three groups, it was not used in the survey. The second or, in some cases, third name on the page (the first name not falling in one of the three groups) was used in its place. Five additional names (the last names listed on pages 50, 100, 150, 200 and 250) were included for "good measure." Thus, questionnaires were mailed to 348 people.

TECHNICAL WRITING

EXECUTIVE OPINIONS

ABOUT YOUR EXPERIENCE

1. How many years of professional experience have you had? (Include industrial, business, consulting, government, and management experience--not academic experience.)

   _____

2. About what percentage of your time is spent in writing?

   _____%

3. About what percentage of your time is spent working with materials that other people have written?

   _____%

4. How important is the writing that you do, and is the ability to write effectively needed in your present position?

   ☐ Minimal importance ☐ Some importance ☐ Very important ☐ Critical importance

5. Generally, have you spent more or less of your time writing as your responsibilities increased?

   ☐ More ☐ Less

6. Have you spent more or less of your time working with written material as your responsibilities increased?

   ☐ More ☐ Less

7. To what extent has the ability to communicate on paper affected your own advancement in responsibility?

   ☐ Helped ☐ No effect ☐ Hindered

8. When you select or approve someone for advancement, you must, of course, consider many factors. If an individual is otherwise qualified, can inability to write effectively delay or prevent advancement?

   ☐ Ability to write is not usually important--has little or no effect on selection

   ☐ Ability to write is sometimes helpful--may have some effect on selection

   ☐ Ability to write is usually important--often affects selection

   ☐ Ability to write is usually critical--has strong effect on selection

ABOUT SCIENTIFIC AND ENGINEERING CURRICULA

1. Should a course in Technical Writing be included in Scientific and Engineering curricula?

☐ No

☐ As an elective- no effort to encourage students to take it

☐ As an elective- encourage students to take it

☐ As a required course

2. Some courses in technical writing are good and others are pretty poor. If a course in technical writing is included in the curriculum, what topics should be covered?

Essential	OK	Not Important	
☐	☐	☐	Grammar and syntax
☐	☐	☐	Mechanics (punctuation, abbreviations, capitalization, use of numbers, etc.)
☐	☐	☐	Style and tone of expression
☐	☐	☐	Clarity of expression
☐	☐	☐	Analyzing a situation and producing a communication to fit the reader's needs
☐	☐	☐	Organization of reports and other communications
☐	☐	☐	Finding and using published information
☐	☐	☐	Process of writing the draft and completing the finished document

Other Suggestions

3. What should be the main emphasis in such a course--the most important things that a student should learn or be able to do as a result of taking it?

ANY COMMENTS YOU MAY CARE TO ADD ABOUT THE IMPORTANCE OR RELATIVE UNIMPORTANCE OF THE ABILITY TO WRITE EFFECTIVELY FOR SCIENTISTS AND ENGINEERS WILL BE MUCH APPRECIATED, AS WILL BE ANY SUGGESTIONS ABOUT COURSES IN TECHNICAL WRITING.

Yes	No	
☐	☐	Please send me a summary of the results when they are available.
☐	☐	You may use my name and quote my comments in publishing the results of the survey.

_____
Signature

Please return to:

AFIT/ENH
Prof. Richard M. Davis
School of Engineering
Wright-Patterson AFB, OH 45433

DEPARTMENT OF THE AIR FORCE
AIR FORCE INSTITUTE OF TECHNOLOGY (AU)
WRIGHT-PATTERSON AIR FORCE BASE, OHIO 45433

In developing curricula for scientific and engineering schools, faculty members usually argue at length about the courses to be included. One of the courses on which there are often differences of opinion is technical writing--should it be included and, if so, should it be required?

It seems to me that experienced and successful scientists and engineers are in a better position than most faculty members to judge the need for and usefulness of such a course. So, I am soliciting any thoughts you may care to pass along about it.

I would very much like to receive your opinions and suggestions and will certainly appreciate any time you may take to complete the enclosed form and return it to me.

Sincerely,

Richard M. Davis

RICHARD M. DAVIS
School of Engineering

III Results

Of the 348 questionnaires mailed, 16 were returned as undeliverable because of faulty address, because the addressee had moved without leaving a forwarding address, or because the addressee was deceased. Of the remaining 332 potential replies, 245 were received. As has been indicated, the recipients of the questionnaires were prominent engineers, managers, and executives with heavy demands on their time and little to gain from responding to the questionnaire, so a 30 percent return would not have been surprising, and a 35 or 40 percent return would have been considered good. The 73.8 percent return received seems most unusual under the circumstances.[1] Evidently, as Dr. Gordon H. Millar, Vice President of Engineering, Deere and Company, observed in his comments, the survey hit a raw nerve with the recipients.

The responses to each of the survey questions will be presented in turn in the following paragraphs.

Questions about the Respondent's Experience

1. How many years of professional experience have you had? (Include industrial, business, consulting, government, and management experience -- not academic experience.)

Minimum number reported	-	12
Maximum number reported	-	63
Mean years per respondent	-	32.94

Clearly, the respondents are seasoned and experienced in their fields. The replies received are based upon the separate thinking of 245 successful practitioners with an average of just under 33 years experience apiece -- or a total of over 8000 years of experience.

---

[1] The percentage of return from people who actually received the questionnaire was probably somewhat higher. Some questionnaires were probably lost in the mail (going and coming) and some may simply have been disposed of because the intended recipient was no longer at the address given. Twelve of the responses received were from people other than the original addressee (generally, someone occupying the original addressee's former position) and about sixty of the respondents indicated new positions within their companies or wholly new addresses on their replies. Evidently successful engineers assume new duties fairly regularly!

2. About what percentage of your time is spent in writing?

Minimum percentage reported	- 1
Maximum percentage reported	90
Mean percentage per respondent	- 24.35

On the average, the respondents spend just under one-fourth of their time writing -- reports, memoranda, policy, procedures, letters, and other communications. This is a very substantial portion of anyone's working time.

3. About what percentage of your time is spent working with materials that other people have written?

Minimum percentage reported	- 1
Maximum percentage reported	- 90
Mean percentage per respondent	- 30.9

On the average, the respondents spend about 30 percent of their time working with materials that other people have written. Again, that's a lot of anyone's time. The respondents should be very conscious of the most common deficiencies in the material with which they work and in an excellent position to suggest what is really important to the recipient of a given communication and the areas in which improvement is most often needed.

4. How important is the writing that you do, and is the ability to write effectively needed in your present position?

Minimal importance	- 0
Some importance	- 9
Very important	- 124
Critical importance	- 110
No response	- 2

Not only do the respondents spend a substantial portion of their time writing, but they report that the writing that they do is very important or of critical importance in their positions. None of them feel that

it is unimportant. Together with the responses to the earlier questions, this should counter the impression of some that supervisors simply approve and sign reports and other documents prepared by people at lower levels.

5. Generally, have you spent more or less of your time writing as your responsibilities increased?

More	-	155
Less	-	77
Same	-	7
No response	-	6

In practice, it appears that the majority of the respondents have done more rather than less writing as their responsibilities increased.

Evidently, a third choice box, "same", should have been provided on the form as seven of the respondents simply drew on a third box and checked it. Had it been provided on the form, others might have chosen it.

6. Have you spent more or less of your time working with written material as your responsibilities increased?

More	-	230
Less	-	8
Same	-	3
No response	-	4

As responsibilities increased, the respondents spent less of their time developing actual details of specific jobs and more time considering the work of others, making decisions from it, and inaugurating and carrying out appropriate action.

Here again it appears that provision should have been made for a third choice. Three of the respondents drew their own "same" box and checked it, and others may have made that choice if it had been provided on the form.

7. To what extent has the ability to communicate on paper affected your own advancement in responsibility?

Helped	-	236
No effect	-	5
Hindered	-	3
No response	-	1

Clearly, the respondents feel that the ability to communicate on paper has helped them in their own advancement in their professions. It should be noted that two of the three people who checked the "hindered" response added notes to the effect that it was their initial inability (not their ability) to write effectively that hindered them. In the effort to keep the form and answering simple, some ambiguity was present here.

8. When you consider someone for advancement, you must, of course, consider many factors. If an individual is otherwise qualified, can inability to write effectively delay or prevent advancement?

Ability to write is not usually important - has little or no effect on selection	-	1
Ability to write is sometimes helpful - may have some effect on selection	-	25
Ability to write is usually important - often affects selection	-	153
Ability to write is usually critical - has strong effect on selection	-	63
No response	-	3

The ability to write is important to an individual's advancement in engineering fields. Eighty-nine percent of the respondents stated that -- other considerations aside -- ability to write is usually an important or a critical consideration when a subordinate is considered for advancement.

Questions about Curricula

1. Should a course in Technical Writing be included in scientific and engineering curricula?

No	-	5
As an elective--no effort to encourage students to take it	-	3
As an elective--encourage students to take it	-	39
As a required course	-	196
No response		2

The overwhelming preponderance of the respondents indicated that they feel that all students in scientific and engineering curricula should either be required or be encouraged to take a course in technical writing. 80.6 percent felt that it should be required of all students and 16 percent felt that it should be an elective with all students encouraged to take it. Only 3.5 percent differed from this judgment.

2. Some courses in technical writing are good and others are pretty poor. If a course in technical writing is included in the curriculum, what topics should be covered?

Eight very general topic areas of possible coverage were listed for the respondent's evaluation; most courses in technical writing include some or all of them. Three possible answer choices were provided for each of the topics, and space was provided for other suggestions by the respondents. The total number of choices indicated for the topics were as follows:

	Essential	OK	Not Important	No Response
Grammar and syntax	165	75	0	5
Mechanics (punctuation, abbreviations, capitalization, use of numbers, etc.	120	103	12	10
Style and tone of expression	117	115	7	6
Clarity of expression	239	4	0	2
Analyzing a situation and producing a communication to fit the reader's needs	209	31	0	5
Organization of reports and other communications	189	50	3	3
Finding and using published information	90	127	22	6
Process of writing the draft and completing the finished document	151	79	7	8

The respondents appear to feel that all of the general topics listed are appropriate for inclusion in a course in technical writing. Even the topic with the lowest number of "essential" ratings (Finding and using published information) was rated as "not important" by only 22 of the respondents. The two topics most highly rated (Clarity of expression and Analyzing a situation and producing a communication to fit the reader's needs) approached unanimous "essential" rating. Further, many of the responses to question 3 (following) and many of the additional comments added by the respondents following the questions touched upon these two topics.

Sixty-two of the respondents listed one or more other suggestions for possible course content. The general topic of brevity (under a variety of names -- directness, conciseness, economy, and others) was the most often mentioned (15 mentions). The following topics were mentioned three or more times:

Brevity	-	15
Spelling	-	6
Outlining	-	4
Preparation & use of graphic aids	-	3
Dictation & working with a secretary	-	3
Grammar and diagramming	-	3
Reading general & scientific literature	-	3

3. What should be the main emphasis in such a course -- the most important thing that a student should learn or be able to do as a result of taking it?

Of the 245 respondents, 207 supplied specific answers to this question. A tally of the number of specific mentions of individual points appearing in three or more responses is listed below. Some of the general categories obviously overlap but have been listed separately to retain the emphasis indicated in the responses received. The terms used to identify the categories are those that occurred most often in the remarks -- the respondents having stated essentially the same points in a variety of ways.

Clarity (directness, simplicity, unambiguousness, not to be misunderstood, comprehensibility, no ambiguity, etc.)	-	109
Brevity (conciseness, compactness, no extraneous words, succinctness, etc.)	-	73
Logical order (organization of ideas, continuity of thought, outline, not jump around, etc.)	-	53
Write for reader (user's needs, reader's viewpoint, etc.)	-	40
Communicate the intended message	-	16
Grammar, punctuation, mechanics	-	15

Avoidance of cliches, jargon, unnecessary professional words	-	12
Precision, accuracy	-	11
Practice in getting started and actually writing quickly	-	10
Conclusions (evident and clearly supported)	-	8
Editing and rewriting	-	4
Carrying out complete project and producing completed report	-	4
Capture reader interest	-	3
Paragraphing	-	3

The general trend of the responses is that the student should be able to organize and prepare a written communication that will communicate the information that the reader needs clearly, concisely, and in a logical order. This, of course, approximates the stated purposes of many courses in technical writing -- whether achieved or not. All responses for which permission was given for quotation are listed in Appendix A.

Comments

> Any comments you may care to add about the importance or relative unimportance of the ability to write effectively for scientists and engineers will be much appreciated, as will be any suggestions about courses in technical writing.

One hundred sixty-nine of the respondents added comment either in the space provided or in accompanying letters. Although other matters were touched upon, the majority of the comment was directed to five points:

1. The critical importance of effective writing to individual advancement. Generally, people who cannot write well will not be promoted to positions of greater responsibility.

2. The importance of effective written communications in business, industry, and government.

3. Deficiencies in the abilities of young engineers to write effectively.

4. Common deficiencies in written communications and what is needed to make them better.

5. Possible content and emphasis in courses in technical writing.

In the opinion of the respondents, then, effective written communication is very important in any engineering or management activity. Except in very unusual cases, engineers who cannot write effectively will not advance in their fields.

Of the 169 respondents who made comment, 131 gave permission for quotation. Their comments are presented in full in Appendix B. Of the remaining 38 who commented, 22 indicated that they would prefer not to be quoted and 16 did not indicate whether or not quotation was permitted.

IV Summary

The results of the survey indicate that the respondents spend a substantial portion of their time (24%) writing; that the writing that they do is very important, often critical, to their positions; and that their ability to write effectively has helped them in their own advancement. Further, a substantial portion of their time (31%) is spent working with material that others have written. They are acutely conscious of the need for effective written communications, find fault with many of the written communications with which they deal, and many feel that young engineers are deficient in their ability to communicate on paper -- this feeling doubtless being based on the substantial portion of their time spent working with materials written by some of the young engineers concerned. They indicate that ability to write is usually important or critical when considering qualified men for advancement, and that point is strongly put in many of the remarks made by the respondents. The following are typical:

> In my long experience and association with scientists and engineers, I can't remember a single instance of anyone advancing to a position of significance who could not express himself effectively on paper.
>
> - Edward R. Zebrowski, Manager
> Rohm and Haas Company
> Philadelphia, Pennsylvania

> Ability to write and communicate is a key factor in progress into management.
>
> - Robert E. Sessions, President
> General Electric Circuit Breakers, Inc.
> Palmer, Puerto Rico

> The most intelligent engineer is of no value to his fellow man unless he can communicate with others, both orally and in writing.
>
> - Richard C. LeVere
> Johns-Manville
> Denver, Colorado

There is no question in my mind that the ability to communicate well, as just described, is very important to an engineer's career. It is a necessary condition to advance beyond about the second level of management in my organization.

- Dr. Brockway McMillan, Vice President
Bell Laboratories
Whippany, New Jersey

Scientists and engineers who do not have the ability to write effectively will be greatly handicapped in the furtherance of their careers, no matter how brilliant or competent they may otherwise be.

- Wesley P. Goss, Chairman of the Board
Magma Copper Company
San Manuel, Arizona

With such recognition of the importance of effective technical writing to the engineer, it is not surprising that the vast majority of the respondents feel that technical writing should be a required course in engineering curricula. Most of the remainder think that it should be an elective which all students should be encouraged to take, and less than 4 percent differ with this judgment. The respondents indicated that the main emphasis in such courses should be on teaching students to analyze a writing situation and then produce a clear, direct, logically developed communication that will meet the reader's needs (focus on the reader, not the writer) without burdening him with extraneous material or long-winded verbiage. Special emphasis should be placed on the need for clarity and ready comprehensibility.

The preceding paragraphs present a distillation of the thinking of 245 prominent engineers, managers, and executives about technical writing as it concerns engineers in industry, business, and government. They write with a combined experience of over 8000 years in a wide variety of engineering fields. Their thoughts are those of practitioners who have been through the mill and emerged as leaders in their fields -- these are the winners. They know the "real world" that many faculty members and students see only "through a glass, darkly" and they should be given a careful hearing by curriculum planners who intend to educate students to be successful engineers. Teachers of technical writing -- many of whom would not know a punch press from a milling machine -- may gain perspective from their

thinking that will help to structure and present courses that will be of practical and lasting value to their students. And certainly the students themselves should be interested in what successful men in their chosen fields have to say -- these men and others like them will hire the students, judge their work, and determine their advancement in their chosen professions. If this doesn't hit home with them, it's questionable whether anything will.

Appendix A

Comments on the Desired Result of a Course in Technical Writing

Question 3 on the curriculum asked, "What should be the main emphasis in such a course (Technical Writing) -- the most important things that a student should learn or be able to do as a result of taking it?" Of the 245 respondents, 207 supplied specific answers to this question. All responses for which permission was given for quotation are listed here, alphabetized in order of the respondent's surname. Where they were available, the respondent's position and company are listed as they appeared in Engineers of Distinction or on the questionnaires returned.

> The ability to present concise writing, prepared in chronological order, using technical verbiage or terms only where necessary to communicate the content to the reader in the most expeditious manner.
>
> Roy L. Aach, President
> Roy L. Aach & Associates
> Clayton, Missouri

> Engineering work involves facts and figures, both of which must be correct, not guessed at, intimated or hinted at. Accuracy and precision should be stressed.
>
> Forrest B. Adams
> Adams, Reid & Associates
> Fort Worth, Texas

> Emphasis should be upon expressing ideas concisely and in a form to suit the recipient.
>
> Charles E. Anderson, Product Planner
> Ampex Corporation
> Redwood City, California

> Clarity in organization of thought prior to writing and in expression of ideas in writing.
>
> Nathaniel Arbiter
> Natural Resources Group
> The Anaconda Company
> Tucson, Arizona

Learn to write in understandable terms for upper management's consumption. Write from the user's viewpoint and be brief and specific.

Guy J. Bacci, II, Manager
Corporate Industrial Engineering
International Harvester Company
Hinsdale, Illinois

Producing a communication to fit the reader's needs.

Gerald L. Baker, President
Woodward-Moorhouse & Associates, Inc.
Clifton, New Jersey

Main emphasis should be on:

1. Communication in terms of the reader's interest and understanding.
2. Clarity of expression
3. Brevity
4. The objective of written communication -- to convey ideas.

Harvey O. Banks, President
Harvey O. Banks Consulting Engineers, Inc.
Belmont, California

To put on paper a concise, clear review of a project which will leave little doubt in the reader's mind as to why the work was done, what were the results, how obtained, and the logical development of conclusions.

Jack P. Barrett
Material Management
Apache Junction, Arizona

Set down ideas briefly and clearly and in good order.

Dr. Robert W. Beatty
Consulting Electronics Engineer
Boulder, Colorado

Organize writing so a clear logical and progressive presentation is made. Too frequently the writer jumps into the middle of a story and then tries to move back to the introduction and forward to the conclusion without a plan. The resultant confusion is everywhere.

Guy Bellows
Meticut Research Associates, Inc.
Cincinnati, Ohio

1. Understand and differentiate between readers (e.g., in-house memo; proposal to DoD; program tech report; technical society paper), and be able to adjust style and approach.
2. Not panic at sight of white paper blank.
3. Be able to write one clear page of thinking in less than 8 hours.

Eli H. Benstein
Teledyne CAE
Toledo, Ohio

Student should be able to express himself clearly without any double meanings or unanswered questions.

Roger W. Billharz
Consulting Engineer
Tarrytown, New York

Write a clear, concise, accurate, well-organized report suited to the needs of the reader.

Fred W. Blaisdell
Agriculture Research Service
St. Anthony Falls Hydraulic Laboratory
Minneapolis, Minnesota

Proper organization of the material and brevity and clarity of expression.

George W. Boase
Division Superintendent, Rolling
U. S. Steel Corporation
Chicago, Illinois

(a) How to organize a technical report
(b) Language and vocabulary should be adult but not so sophisticated that a lay person could not comprehend.
(c) Do not use stereotyped phrases or cliches.

Stuart H. Bogue, President
Pate, Hirn & Bogue, Inc.
Southfield, Michigan

A student should be able to communicate precisely, without cliches.

Jack A. Bono, Assistant Chief Engineer
Underwriters' Laboratories, Inc.
Northbrook, Illinois

Techniques for producing a communication to fit the reader's needs, including the effective use of draft material.

Richard J. Bouchard
Office of Secretary of Transportation
Washington, D.C.

1. Learn to organize materials in a cohesive form!
2. Writing in a direct, forceful fashion -- without convoluted phrasing.
3. Writing to the vocabulary and understanding of the recipients.

Warren L. Braun
Consulting Engineer
Harrisonburg, Virginia

The sequence of outline -- to draft -- to final ms.

Dr. Jere H. Brophy, Manager, Research Laboratories
International Nickel Company
Suffern, New York

To present his ideas clearly and with proper punctuation, etc.

Franklin P. Burn, Vice President
Hubbell, Roth & Clark, Inc.
Consulting Engineers
Bloomfield Hills, Michigan

Learn to say neither too little nor too much; learn to give the essential background to a statement or a report without overburdening the reader; learn to include enough ancillary or supporting reasons so that the reader sees the reasonableness of your conclusions.

Joseph M. Caldwell
Engineering Consultant
Arlington, Virginia

Short, simple, clear sentences, in logical sequence.

Hallock C. Campbell, Manager, Education
American Welding Society
Miami, Florida

The student should be able to report his findings or results in such a manner that it doesn't require rewriting or interpretation by the reader. It should be suitable for submission to the president.

Craig W. Cannon
Allis Chalmers Corporation
AG Equipment Division
La Porte, Indiana

He should be able to communicate clearly and concisely on paper!

Ronald N. Caozier, Senior Engineer
Thiokol Chemical Corporation
Brigham City, Utah

Clarity without being verbose.

Cecil C. Chapman
Chapman Engineering Company
Williston, South Carolina

Be able to express ideas clearly and concisely.

Lester D. Chipmen, Manager
Corporate Personnel & College Relations
Western Electric Company
New York, New York

Ability to write not only to be understood, but not to be misunderstood.

William A. Conwell, Vice President (Ret.)
Duquesne Light Company
Pittsburgh, Pennsylvania

Be understood.
Be brief.
Have sufficient command of grammar, syntax, and mechanics that he doesn't distract the reader.

Maj Gen Kenneth B. Cooper
Assistant Chief of Engineers
Dept. of the Army (DAEN-ZC)
Washington, D.C.

(1) Express himself clearly and concisely.
(2) Present his position in a well-reasoned manner which will make it easy for his reader to grasp his arguments or data and take action.

Burton B. Crocker
Senior Engineering Fellow
Monsanto Company
St. Louis, Missouri

Organization, clarity, tone and brevity to fit the reader's needs are essential and should be emphasized.

L. B. Curtis, Manager, Engineering Production
Continental Oil Company
Houston, Texas

Preparation and editing of a communication which will precipitate a favorable decision.

Roy E. Dahlin, P.E.
Western Institute of Light & Vision
Rancho Mirage, California

Express a problem clearly, analyze solutions, prepare succinct recommendations.

Philip S. Davy, President
Davy Engineering Company
La Crosse, Wisconsin

Present a proposal clearly, emphasizing the significant advantages to the recipient.

Fred N. Dickerman, Consultant
Lockheed-Georgia Company
Pinellas Park, Florida

To make writing, the written word, come through like talking.

Joseph K. Dillard, Manager
Advanced Systems Techniques
Westinghouse Electric Corporation
E. Pittsburgh, Pennsylvania

Express himself simply and directly in a clear and organized manner that will read clearly.

Wallace L. Donley, President
W. L. Donley & Associates
Fresno, California

Organization. Most reports do not fail on content, but on the lack of a clear goal and a logical step-by-step approach to proceed from the background or "givens" to that goal.

Robert O. Drange, Partner
Howard, Needles, Tammen & Bergendoff
Kansas City, Missouri

Express himself to his advantage.

Charles W. Durham
President, Chairman of the Board
Henningson, Durham & Richardson, Inc.
Omaha, Nebraska

Concentrate on rather short reports involving a limited amount of data and other information to be presented. This is the area the young engineers bump into as soon as they go into industry. Forget about long, formal and involved reports -- the engineer can work up to these on his own while in industry.

Carl J. Eaton, Director of Research
Champion Spark Plug Company
Toledo, Ohio

Effective communication.

Clyde Edwards, Vice President
Williams Brothers Waste Control, Inc.
Tulsa, Oklahoma

Expressing an idea or ideas in a clear and concise form.

Dr. W. B. Eisen
Manager of M-11 Metallurgy
Crucible, Inc.
Syracuse, New York

Practice, practice, practice. And -- enlist the support of other departments to demand excellence in reports. A correct answer is no good if it won't sell!

John C. Ellis, Manager
Vehicle Emissions Control
Shell Oil Company
Washington, D.C.

1. Write a good sentence.
2. Follow #1 with a paragraph.
3. After writing paragraphs -- be able to organize them into a report.
4. Prepare summaries, abstracts, and conclusions in the report.

Eugene A. Eschbach, Staff Scientist
Battelle Memorial Institute
Richland, Washington

1. Analyze the writing from the reader's viewpoint.
2. Reduce written reports to the essential information.
3. Organize the written report into its most useful form.

Robert W. Exline, Executive Vice President
Williams Brothers Pipe Line Company
Tulsa, Oklahoma

To write clearly, briefly and to the point.

Norman R. Farmer, Manager
Systems Analysis Department
George G. Sharp, Inc.
Millburn, New Jersey

Write with empathy for the reader. Recognize and present only pertinent matter tersely in such a manner that facts are clearly differentiated from opinion. Use both for deducing logical conclusions. Organize the writing so that each paragraph compels the reader to "read on."

Dr. Charles L. Faust, Private Consultant
Columbus, Ohio

Convey information in a concise form intelligible to the class of persons to whom the information is addressed.

Dr. Alexander H. Flax, President
Institute for Defense Analysis
Arlington, Virginia

The ability to describe, clearly, a situation with understandable accuracy and to project one's thoughts cogently.

Frank F. Ford, President
Frank F. Ford & Associates
Atlanta, Georgia

He should be able to write a technical paper oriented to the reader who will ultimately use the report for decision making or as a piece of useful information in setting organizational objectives. In the case where writing may be technically complex, the writer should be prepared to summarize the report for the benefit of those who have an interest but are not directly responsible for application.

Gerrit D. Fremouw, Director
Office of Facilities Engineering &
Property Management, HEW
Washington, D.C.

The ability to prepare an outline, to let the reader know what the conclusions are and how they are developed, and what action is required of the reader. I found that writing and rewriting, (and rewriting again), with proper instruction help, working on the same report or letter was a great help in improving my communications capability.

Dr. David L. Fried, President
Optical Science Consultants
Yorba Linda, California

To think clearly, to organize his thoughts, to plan the report (outline) before starting to write.

John B. Giacobbe, Vice President,
Metallurgy
Superior Tube Company
Norristown, Pennsylvania

All of the above (vocabulary enrichment, coherence, logical development, succinctness).

Dr. Lester Goodman, Branch Chief
National Institute of Health
Public Health Service
Bethesda, Maryland

The main emphasis in such a course should be on training the students to define the subject and purpose of the paper or report, and to present the material conclusions, recommendations, if pertinent, in clear, concise, grammatically correct language.

Wesley P. Goss, Chairman of the Board
Magma Copper Company
San Manuel, Arizona

Be able to express himself in a manner that he wants to be understood or heard.

W. William Graham, Jr., President
W. William Graham, Jr., Inc.
Little Rock, Arkansas

Write: Simply, clearly, quickly.

William H. Greenbaum, Vice President &
Director
Unilux, Inc.
Hackensack, New Jersey

That the understanding of all communications comes from the recipient--not the originator.

R. Dean Grimm, President & Chairman
Intermountain Gas Company
Boise, Idaho

Be able to be specific in minimum of words. Ability to sell self, or ideas. Prevent confusion with a lot of words which say nothing.

Edward E. Gygax, President
Gygax Engineering & Equipment Company
St. Louis, Missouri

Organize his material, select format. Write rough draft and fill in missing data. Complete rough draft. Do not put too much data in graphs--keep them simple and clear. Use graphs instead of tables to show trends.

Donald J. Hagemaier, Senior Engineer & Scientist
Douglas Corporation
Huntington Beach, California

Produce a clear, concise idea or theme.

Joseph C. Hall, Superintendent
Fabrication Shops
Union Carbide Corporation
Oak Ridge, Tennessee

a. Review and analyze reports of others to get main ideas.
b. Identification and use of reference systems.
c. Perform actual research and writing of good technical report with all necessary ancillary tasks; e.g., make questionnaire, request answers, evaluate; letters of request for information; search bibs, etc.

William L. Hanbury, Executive Director
Federal Fire Council
Washington, D.C.

Prepare written material in a clear, concise, and well-organized manner -- not wordy but in sufficient detail to insure that subject is adequately presented.

G. L. Hancock, Jr., Production Advisor
Gulf Oil Company - U.S.
Houston, Texas

Analyzing a situation and producing a communication to fit the reader's needs.

Carlton H. Hastings
Army Materials & Mechanics Research Center
Department of the Army
Watertown, Massachusetts

Not to be "wordy." To express the point of the communication. If hand-written, make it so that someone else can read it.

Melvin J. Helmich, Director, Recip. Production
Cooper-Bessemer Company
Mt. Vernon, Ohio

Clarity of expression!

Dr. Theodore R. Higgins
American Institute of Steel Construction, Inc.
New York, New York

Write pithy, interesting stuff. Professorial bullshit must be stuffed.

Dr. Conrad R. Hilpert
Manor, Pennsylvania

Improve the ability to communicate.

Ludwig C. Hoffman, Vice President
International Maritime Association, Inc.
Washington, D.C.

1. Complete a sentence without changing the subject.
2. Have the subject and verb agree in number.
3. Avoid dangling participles, etc.
4. Use the accusative case for the object of prepositions.
5. Place modifiers, such as "only", in the correct position in the sentence.

Dr. Marshall Holt (Ret.)
Alcoa Research Laboratories
New Kinsington, Pennsylvania

He should have a good understanding of the requirements of an effective report, paper or letter. He should have a good grasp of basic essentials of English composition.

Myles R. Howlett, Director of Engineering
Forest Services
U.S. Department of Agriculture
Washington, D.C.

To impress on the student that he is not writing to inform only himself -- that people are different, men think differently and he must know and understand the man who will be evaluating the letter or material for his decision. Technical papers, of course, stand on their own merit -- but again the writer must understand his reading group.

Horace S. Hunt, Jr., Vice President
Brown & Root, Inc.
Oak Brook, Illinois

Stress the five things I marked as essential in Item 2 (style and tone, clarity, analyzing the situation, organization, finding published information).

J. D. Hylton
Cameron Engineers, Inc.
Denver, Colorado

Importance of communicating.

Dr. Wayne H. Jens, Project Manager
The Detroit Edison Company
Detroit, Michigan

The writer or speaker is responsible for the communication he is rendering. He should know the reader(s) knowledge level of the subject -- not assume. A summary and recommendation or conclusion at the beginning of a lengthy report is appreciated by busy executives.

George W. Johnson, Manager, Quality Assurance
Aircraft Wheel & Brake Division
Goodyear Aerospace Corporation
Akron, Ohio

Learning to write a simple declarative sentence seems to be a lost art form. It is basically important that the student be able to translate the usual convoluted engineering procedures into easily understood, non-ambiguous language.

William S. Kaplan, Vice President
Sexton, Fitzgerald & Kaplan, Engineers
San Francisco, California

Analyzing information and clarity in organization of reports to fit reader's needs.

Norman O. Kates, Vice President, Technology
Lindberg Corporation
Chicago, Illinois

Must be able to clearly define a problem or a situation and present an approach to resolving the problem itself or difference of opinions on any subject. Arguments must be clearly and convincingly stated.

Dr. Fazlur R. Khan
Partner & Chief Structural Engineer
Skidmore, Owings & Merrill
Chicago, Illinois

To be able to express himself concisely and completely; to anticipate the background information the reader needs and to supply it; to be able to sum up the fundamental points being made, decisions required, etc., and not bury it in supporting data.

Robert W. King, Director, Manufacturing
NAO
Massey-Ferguson, Inc.
Detroit, Michigan

Analyzing a situation and producing a communication to fit the reader's needs.

David L. Klepper
Klepper Marshall King Associates, Ltd.
White Plains, New York

How to start.

Dr. Rudolf Kompfner
W. W. Hausen Labs of Physics
Stanford University
Stanford, California

On grammar and clarity of expression.

John F. Laboon, Consulting Engineer (Ret.)
Pittsburgh, Pennsylvania

Clarity and use of correct and accepted terminology, particularly terminology accepted by international (standard) organizations.

Dr. Uno A. Lamm, Engineering Consultant
Hillsborough, California

Effective communication.

Allen Latham, Jr.
Haemonetics Corporation
Jamaica Plain, Massachusetts

Accurate conveyance of information and ideas.

Charles H. Lawrance
Koebig & Koebig, Inc.
Redondo Beach, California

Prepare a clear, concise exposition.

George H. Leland, President
Edwards & Kelcey, Inc.
Newark, New Jersey

To get to his point quickly without using a lot of extraneous words that do nothing but make his report more lengthy.

Will J. Lessard, Executive Vice President
Main Engineers
Boston, Massachusetts

Communicate his technical thoughts to others. Prepare and write a clear and understandable report of his findings.

Richard C. LeVere
Johns-Manville
Denver, Colorado

1. Make detailed outline of manuscript.
2. Know what he wants to say and make sure outline will say it.
3. See that each sentence says what you want it to say and that it can't be misinterpreted.

Jordan H. Levin
Location & Research Leader
USDA-ARS-North Central Region
East Lansing, Michigan

Engineer writing; state facts; give conclusions.

Howard O. Lorenzen, Superintendent
Space Systems Division
Naval Research Laboratories
Washington, D.C.

a. Analyzing a situation and producing a communication to fit the reader's needs.
b. Process of writing the draft and completing the finished document.

Dr. John H. Ludwig
Santa Barbara, California

The main emphasis should be on style and clarity of expression. It is important that the writer not only know his subject but that he can analyze the material to the extent that he provides the reader with the necessary information for a complete message without having to wade through extraneous and superfluous material.

Oscar T. Lyon, Jr., Ch Deputy State Engineer
Arizona Department of Transportation
Phoenix, Arizona

Main emphasis in a required writing course should, in my opinion, be:

a) the elements of English composition (unity, coherence, emphasis)
b) practice in writing (assigned themese, topics, etc.).

Vernon G. MacKenzie (Ret.)
U. S. Public Health Service
Sanibel, Florida

To be able to communicate his technical work in simplistic language which will allow a non-technical manager to be able to understand and act on the information.

James E. Mahoney, Director
Office of Management Planning
Office of the Secretary
Department of Health, Education & Welfare
Washington, D.C.

Write for the reader, not for the writer.

Dr. Daniel W. Martin, Chief Engineer
Baldwin Piano & Organ Company
Cincinnati, Ohio

Simply to communicate to the reader in a concise, effective way, non-ambiguously, what the writer has to say.

Raymond C. Mason, President
Mason-Johnston & Associates, Inc.
Dallas, Texas

Accuracy, clarity, simplicity, straightforwardness (logic of presentation).

Philip McCallister, Chief, Engineering Division
Detroit District Corps of Engineers
Department of the Army
Detroit, Michigan

Grammar, spelling and item 4 above (clarity of expression). And, of course, understanding the importance of good writing; why it really is a valuable professional asset.

Rex R. McHail, Photogrammetrist
Bausch & Lomb
Rochester, New York

1. Grammar
2. Collection of facts or data
3. Brevity
4. Courtesy

Harold F. McKnight, President
McKnight Engineers, Inc.
Charlotte, North Carolina

1. Put himself behind the reader's glasses and read what he writes from the point of view of the intended audience.
2. Write with clarity, precision, and without monotony.

Dr. Brockway McMillan, Vice President
Bell Laboratories
Whippany, New Jersey

The principal emphasis should be upon developing the skill to penetrate to the heart of an issue and express its statement, analysis, and interpretation in brief and uncluttered manner.

Dr. Robert V. Meghreblian, Director of Technology
Cabot Corporation
Boston, Massachusetts

To express themselves clearly and concisely, in an ordered fashion and in a logical format.

James C. Mitchell, Environmental Scientist
Geoscience, Division of Geosource
Long Beach, California

Course should teach student to effectively organize his material and thoughts to assist in the achievement of purpose for which the written material was intended.

Ernest Moritz
Ernest Moritz & Associates
Baltimore, Maryland

If you can produce a written document that is clear to anyone who reads it--you have achieved the ultimate.

Edward A. Moy, President
Edward A. Moy Consulting/Electrical Engineers, Inc.
Woodbury, New Jersey

Concise combination of facts.

Rear Admiral Albert G. Mumma, USN (Ret.)
Short Hills, New Jersey

Technical writing must be clear, to the point, and understandable. Upon completion of such a course, a student should be able to produce technical writings, such as technical reports, technical papers, technical letters, as well as well-written business letters. In addition, a student graduate of such a "class" should be well groomed for participation in technical seminars and technical discussions.

Wayn A. Nagel, P.E.
Naval Sea Systems Command
Department of the Navy
Washington, D.C.

He should learn that if he cannot express himself clearly to the person he is addressing, the effort in producing the work involved may be wasted.

Raymond M. Nee
The American Society of Mechanical Engineers
New York, New York

Communicate concepts fluently.

Ralph L. Neubert, Director, Strategic Planning
Monsanto Company
St. Louis, Missouri

Technical Writing is a misnomer. I believe the course should deal with good communication.

Joseph H. Newman, Senior Vice President
Tishman Research Corporation
New York, New York

Write a report.

Brigadier General Wayne S. Nichols
Division Engineers
Ohio River Division
Cincinnati, Ohio

Learn to be brief and to [cover] the main points in the clearest possible manner. Also emphasize the need for good oral presentation.

John C. Niedermair, Sr., Naval Architect
Stone Harbor, New Jersey

Write brief, simple reports with no reliance on technical jargon.

Joseph B. Olivieri, President
OEM Associates, Inc.
St. Clair Shores, Michigan

As noted above, organize it to carry the intended message with no ambiguity. Emphasize clarity of expression -- avoid obscurities. Keep the intended reader's background and knowledge in mind. Emphasize the importance of an abstract or introduction that summarizes the argument. End with clear recommendations and conclusions.

Eugene F. O'Neill, Executive Director,
Toll Transmission Division
Bell Telephone Laboratories
Holmdel, New Jersey

Being able to express himself in terms that will be clearly understood by those who must understand him.

Charles E. Otis
Charles E. Otis & Associates
Warwick, Rhode Island

Sentence Structure and paragraph organization.

Robert E. Philleo
Office, Chief of Engineers
Department of the Army
Washington, D.C.

Analysis, structuring and organization of the material before putting pen to paper.

Dr. Gerard Piel, Publisher
Scientific American
New York, New York

They can put into writing what they mean.

Miles B. Potter, P.E.
Municipal Environmental Associates
Warminster, Pennsylvania

Clarity of expression. Writing for your audience; i.e., other engineers or laymen. Being able to edit and shorten first drafts so as to not be too verbose.

Richard J. Proctor, Chief Geologist
The Metropolitan Water District of
Southern California
Los Angeles, California

Communicate his ideas such that they will not be misunderstood.

Daniel Queen
Daniel Queen Associates
Chicago, Illinois

Clarity of expression; organizing reports, etc.

George S. Rawlins, Vice Chairman of the Board
J. N. Pease Associates
Charlotte, North Carolina

The writer should be able to summarize, clearly and briefly, the subject and action recommended -- then present supporting information in a typical sequence with a minimum of text.

Robert L. Reitinger, Chief Engineer
Rohm & Haas Company
Philadelphia, Pennsylvania

Clarity of expression and compactness are essential.

Dr. George R. Rich, Senior Vice President
Charles T. Main, Inc.
Wellesley Hills, Massachusetts

To communicate effectively under almost any situation.

Louis C. Ripa, President and Chairman of the Board
Porter & Ripa Associates, Inc.
Morristown, New Jersey

A student should be able to communicate technical information to others clearly and concisely -- both to technically trained and non-technical people.

Robert E. Roberts, President
Fred T. Roberts & Company
Wilton, Connecticut

I believe a course which <u>combines</u> grades for technical content (e.g., laboratory reports) with grades for writing competence would be useful.

Dr. Lewis H. Rogers, Executive Vice President
Air Pollution Control Association
Pittsburgh, Pennsylvania

Write clearly, simply, and unmistakably in an organized, logical sequence.

Major General Willard Roper, USA (Ret.)
Metcalf & Eddy, Ltd.
Bangkok, 4, Thailand

Effectively address special categories of readers. Develop and present effectively complex technical subjects in a succinct and convincing manner.

Robert W. Rummel, Vice President, Technical Development
TransWorld Airlines, Inc.
New York, New York

The student should understand the differences in degree of obligation in writing directions and specifications. The various shading of words such as "shall", "should", "will", "may", etc. has a serious effect on meaning in writing.

Robert J. Salinger, Chief of Engineering
C. F. Murphy & Associates
Chicago, Illinois

Speaking.

Joseph S. Schumacher, Foundry Technical Director
International Minerals & Chemicals Corporation
Libertyville, Illinois

Learn the importance of rewriting drafts two, three or more times to achieve good writing in any manuscript.

Joseph E. Sebald, Consulting Engineer
Bloomfield, New Jersey

Be able to express his ideas succinctly.

Robert E. Sessions, President
General Electric Circuit Breakers, Inc.
Palmer, Puerto Rico

Organization of ideas, clarity, conciseness, easy style (not jargon or stilted), format. Keep in mind -- you are selling -- selling your ideas, your findings, your conclusions, etc.

Ronald L. Sharpe, Vice President
Engineering Decision Analysis Company
Palo Alto, California

Minimize number of words and copies. Organize paragraphs so paragraph subjects can be picked out by scanning.

Lloyd O. Shorter, Manager, Systems Engineering
Delmarva Power & Light Company
Wilmington, Delaware

Ability to transmit thoughts in a clear and concise manner so that others will understand.

Sidney A. Silver, P.E.
Silver, Schwartz & Associates
Washington, D.C.

Relate concisely and in fundamental terms his intended communication.

Dr. Alex Simkovich
Latrobe Steel Company
Latrobe, Pennsylvania

Write clearly, precisely, and for the particular audience concerned.

E. Ralph Sims, Jr.
E. Ralph Sims, Jr. & Associates, Inc.
Lancaster, Ohio

To clearly and logically present the subject of the writing in terms that are simple for non-professional persons to interpret.

Metz K. Skelton
Skelton & Associates, Inc.
Kennett, Missouri

To write clearly and briefly, and to include essential support for opinions.

John E. Slater, Executive Vice President, (Ret.)
American Export Lines
Essex Falls, New Jersey

To be able to express himself so that his listeners or readers get the message he wants them to have.

Herschel A. Sosnin, Consulting Engineer
Jenkintown, Pennsylvania

If English were properly taught in the home and the secondary schools, there would be little need for advanced courses in college for technical people -- but sadly, teaching in lower schools is not what *it should be.*

Frank Y. Speight, Manager, Safety & Health
American Welding Society
Miami, Florida

Ability to translate thoughts, ideas, events, their interpretation on paper.

Philip Sporn, Consultant
New York, New York

Hopefully, the student would derive the ability to write a well-organized, lucid account of any work, research or otherwise, which he has performed or been a part of.

Stephen D. Stoddard, Ceramics Section Leader
University of California
Los Alamos Scientific Laboratories
Los Alamos, New Mexico

Student should be able to prepare a report that is clear, accurate, concise, and grammatically correct.

James J. Stout, Chief, Division of Licensed Projects
Federal Power Commission
Arlington, Virginia

Be able to prepare a concise and easily understandable discussion with clear-cut conclusions and recommendations.

W. Harold Stuart
Geological Engineering Corps Engineers
Portland, Oregon

a. Communication to fit reader's need
b. Organization and presentation

William K. Y. Tao, President
William Tao & Associates
St. Louis, Missouri

Ability to present clearly an engineering problem, outline procedures, describe step-by-step processes, summarize findings and conclusions, and finalize a report clearly.

Hanford Thayer, Consulting Engineer
Tudor Engineering Company
Seattle, Washington

Logical, clear, factual and smooth readable reports.

H. Loren Thompson
Stevens, Thompson & Runyan, Inc.
Spokane, Washington

The student must be able to communicate, in the full sense and meaning of the word.

Richard M. Tracey, President
Tracey & Brunstrom Company
Seattle, Washington

Production of a clear, concise product that will be read by the recipient.

Paul D. Triem
Bohemia, Inc.
Eugene, Oregon

Simplicity and conciseness in presenting data and communicating the writer's thoughts to the reader.

Lloyd B. Underwood, Division Geologist
Missouri River Division
Corps of Engineers
Omaha, Nebraska

Mechanics (punctuation, abbreviations, capitalization, use of numbers, etc.).

Dr. Kent R. Van Horn, Vice President of
Research & Development
Alcoa Company of America
Pittsburgh, Pennsylvania

To learn all the basic facts, to organize them logically, and draw conclusions supported by this accumulated order.

James C. Vaughn (Ret.), Engineer of Water
Purification, City of Chicago
Chicago, Illinois

Clarity and fitting the reader's needs.

Warren Viessman
Environmental Consultant
Baltimore, Maryland

Originate effective communication through reports and correspondence, from design through successful execution. Researchers must also prepare effective proposals.

Thomas J. Vogenthaler, Director
Colorado Energy Research Institute
Golden, Colorado

Clearly express himself.

Henry M. von Oesen, President
Henry von Oesen & Associates, Inc.
Wilmington, North Carolina

Approach to the writing task, outline, appreciation of reader level, forceful word choice, clarity of expression, continuity of thought, brevity. Source information on writing skill improvement.

Alfred S. Wall, Manager
RCA
Moorestown, New Jersey

For persons to understand what he is reading, write at a comprehensive level, not trying to impress reader.

Charles W. Ward, Jr., Foundry Consultant
Benjamin Harris & Company
Louisville, Kentucky

The student should be able to take an assignment and proceed with design, preparation and issuance of a report or specification in the same manner that he would design an engineered item.

Louis J. Weidner, Jr., Senior Nuclear Engineer
Los Angeles Department of Water and Power
Los Angeles, California

Express his ideas clearly and concisely.

Charles W. Wilson, Manager of Marine Sales
Babcock & Wilcox Company
New York, New York

To communicate effectively.

Dr. Richard K. Wilson, Staff Vice
President, Production - Eastern
Region
North American Rockwell
Pittsburgh, Pennsylvania

Be able to write a clear, informative report in the fewest possible words. Verbose, inconclusive, redundant reports are the bane of the business world.

Gilbert R. Wolter, Vice President,
Research & Engineering
Sunbeam Appliance Company
Oakbrook, Illinois

Sequencing the ideas to be put across in the communication; be precise and get to the point.

Edward R. Zebrowski, Manager
Rohm & Haas Company
Philadelphia, Pennsylvania

Spend greater time proofreading!

Dr. Demetrius Zonars
AF Flight Dynamics Laboratory
Wright-Patterson AFB, Ohio

Appendix B

General Comment by Respondents

Following the specific questions on the questionnaire, respondents were invited to add "any comments you may care to add about the importance or relative unimportance of the ability to write effectively for scientists and engineers" that they wished or "any suggestions about courses in technical writing."

One hundred sixty-nine of the respondents added comments -- either in the space provided or in attached letters -- and 131 of these gave permission for quotation. These comments are presented in full on the following pages.

The art of communication has always been difficult to master. Many technical papers are too lengthy for their intended purpose.

All technical recommendations and conclusions must be based upon sound data and criteria. References must be clearly stated and limited when possible. (Where references are not easily available, the reader has no recourse but to accept or reject conclusions.)

The discussion portion of technical material is usually the "meat" of the overall content. Therein, the writer's reasoning and experience should be fully utilized.

Roy L. Aach, President
Roy L. Aach & Associates
Clayton, Missouri

I have answered the foregoing questions as I would have answered them before I retired.

During the last few years before retirement I not only had to write technical bulletins but had to spend considerable time putting the work of other engineers into English.

Apart from a specialty such as writing engineering sales pieces, however, I think the ability to write clearly is important to any professional person -- particularly an engineer or a scientist.

Willard Allphin
Danvers, Massachusetts

Over the years I've been upset many times by tech writers who can't write clear, effective English and by engineers who can't express their ideas in simple, logical terms.

My own schooling in command of the English language was inferior, and I've learned the hard way how to write even moderately well.

Charles E. Anderson, Product Planner
Ampex Corporation
Redwood City, California

Clarity in organization of thought prior to writing and in expression of ideas in writing is of utmost importance.

Nathaniel Arbiter
Natural Resources Group
The Anaconda Company
Tucson, Arizona

I think the ability to write effectively is essential for a consultant because reports are his work product as plans and specifications are the work products of a designer. Most engineers and scientists get some training in writing in school but it is not training in writing consulting reports; it

is training in writing scientific papers. In writing scientific papers, your audience is your peer group (or those with superior knowledge). When I write or review a technical report, I have in mind coping with an audience consisting of three types of people:

1. A layman who knows nothing about the subject;
2. A person who knows more about the subject than I do;
3. A lawyer who is looking for grounds to sue me.

The most common fault I find with young writers is lack of organization. The second most common fault is using two words where one will do.

Gerald L. Baker, President
Woodward-Moorhouse & Associates, Inc.
Clifton, New Jersey

Extremely important! Should not be restricted to "technical writing" and should not be taught by "English majors" but by someone with considerable experience in purposeful communication.

Harvey O. Banks, President
Harvey O. Banks Consulting Engineers, Inc.
Belmont, California

The ability to write effectively is more and more important as more papers, etc. are published. The man who can concisely write to his supervisors will advance over others. Spelling, grammar are very important. The logical development of conclusions from the data at hand needs to be stressed. Any written matter should be done in a positive and forceful way. A wishy-washy written letter or report leaves the reader in doubt, both as to what action should be taken and the ability of the writer.

Jack P. Barrett
Material Management
Apache Junction, Arizona

Work that goes unreported is not only lost, it may be wastefully duplicated by others. (There are many examples of duplication, even when work has been reported.)

Courses in technical writing should be short on lecture time and long on practice in writing by students and in critical review of students' written material by teacher. Such review should not be done in such a way as to embarrass the student. (Teacher can point out errors to class while keeping authorship of a particular paper anonymous.)

Dr. Robert W. Beatty
Consulting Electronics Engineer
Boulder, Colorado

Most technical writers are so stuffy and pedantic that they lose the reader in a short time. A more "down to earth" approach without a vast display of the writer's knowledge of long esoteric words is important. It is not necessary to lose accuracy or precision in such writing if a careful selection of the right word is used. Use of excess words -- such as very -- is a frequent fault.

The above comments can aid a young engineer to write better, get more of his ideas accepted, and carry over to his oral presentations.

In short, writing skills need to be enhanced, not diminished, in emphasis if we wish to produce well-rounded engineers.

Guy Bellows
Meticut Research Associates, Inc.
Cincinnati, Ohio

I have seen so much misunderstanding generated by sloppy, late or turgid writing that I feel strongly that engineers ought to be trained prenatally for it.

Writing, and clarity of communications (between people) in general is lost in current curricula under the emphasis of "The Scientific Method." This is hogwash in a complex corporate environment when you can't get at "The Method" unless you sell the approach to it, its validity and its endpoint "profitability." To do so requires written and oral clear-communication ability.

Any course in year 1 which demands, and reinforces in years 2-4, the need for writing ability -- technical style -- would be worth it.

Eli H. Benstein
Teledyne CAE
Toledo, Ohio

We have used such a course here at Utah State University for some time.

Professor A. Alvin Bishop, Head
Department of Agricultural Engineering
Utah State University
Ogden, Utah

Advancement in the USD Agriculture, Agricultural Research Service, is based on the Civil Service Commission Research Grade Evaluation Guide. Publications are important elements -- overemphasized by evaluation panels in my opinion, but a current fact of life. Writing ability is needed for advancement. I took the first report writing course given engineers at the University of New Hampshire. This course (and subsequent study) has been as useful in my career as many of my engineering courses. My experience reviewing papers of others, government, and society, shows that most writers would benefit by a good report-writing course.

Fred W. Blaisdell
Agricultural Research Service
U. S. Department of Agriculture
Minneapolis, Minnesota

.Written memos and reports are the major communication link between the plant divisions and staffs and between levels of a line organization. The ability to adequately express thoughts in written form is essential. Punctuation and grammar deficiencies and even some weakness in the ability to spell can be offset by employing a competent secretary. However, if you don't have the vocabulary and the ability to organize and express your thoughts, you will never be able to dictate good reports.

George W. Boase, Division Superintendent, Rolling
U. S. Steel Corporation
Chicago, Illinois

A writer must know what he wants to say and then he must be able to say it in the most concise manner possible without leaving out necessary details; in other words -- be brief as thoroughness will permit.

Stuart H. Bogue, President
Pate, Hirn & Bogue, Inc.
Southfield, Michigan

Technical writing is so important that very few positions of responsibility can be administered without it. The legal significances of technical writings is more critical now than ever before.

Jack A. Bono, Assistant Chief Engineer
Underwriters' Labs, Inc.
Northbrook, Illinois

There can be no question that the ability to write clearly and effectively is a must for the engineer in his constant quest to improve our living environment. Without this ability, great thoughts, ideas and programs will go unnoticed.

Richard J. Bouchard
Office of the Secretary of Transportation
Washington, D.C.

Effective writing occurs only when the individual is conversant with and proficient in communicating. I have found most people do not understand that the writing must have some type of feedback mechanism built into the process used to assure the communication was effective!

Warren L. Braun
Consulting Engineer
Harrisonburg, Virginia

Written communication by engineers and scientists must always strive to avoid the pitfalls of jargon characteristic of the legal profession and the insurance industry. In many instances engineers must effectively communicate with non-technical people, such as finance and marketing, in order for their ideas to be utilized.

Leo T. Brinson
Gas Turbine Division
Turbodyne Corporation
St. Cloud, Minnesota

There are, of course a few engineering jobs that require a minimum of writing; e.g., some in construction and some in surveying and mapping. But even here it is necessary to write clearly and exactly even if the writing is brief.

My experience has been in engineering design, research, consultation, and management. In these fields, an engineer is severely handicapped throughout his career if he (or she) cannot write effectively. Generally, if he cannot write clearly, the user will think he does not think clearly.

Joseph M. Caldwell
Engineering Consultant
Arlington, Virginia

Note quotations from our career booklet, copy enclosed: Opportunities in the Welding Industry.

Pay strict attention to your English courses. The ability to write clearly and simply will help in your college courses and pay tremendous dividends in your future work. If you can write good reports, technical articles for publication and papers for scientific or technical meetings, your recognition will be swift and lasting. English is a must. Too many promising people have been halted half-way up the ladder because of their inability to express themselves either orally or on paper.

Hallock C. Campbell, Manager, Education
American Welding Society
Miami, Florida

Any course in technical writing should result in the ability to communicate the ideas and thoughts of the writer to the reader.

Frank M. Coda
Illuminating Engineering Society
New York, N.Y.

Engineers and scientists must develop the ability not only to write understandably to each other but to write in "English" as distinguished from engineering and scientific "folklore" to others. The latter is especially important when writing to or for executives who may not be familiar with the terminology of highly specialized fields. Engineers and scientists must, despite some objections, learn to express their ideas in English and must be convinced that it can be done. One may be in the position of drafting a letter for a superior's signature and will face an impossible situation if he cannot do so in terms his superior can understand. It can be done!

William A. Conwell, Vice President (Ret)
Duquesne Light Company
Pittsburgh, Pennsylvania

Writing effectively is not as important as technical competence. But it enhances significantly the ability of the scientists and engineers to get the job done.

Since it takes only effort and discipline to write effectively, there is no excuse for not learning how.

Maj Gen Kenneth B. Cooper
Assistant Chief of Engineers
Department of the Army
Washington, D.C.

1. Effective communication is absolutely essential to the necessary transfer of ideas from the researcher, to the designer, to the fabricator or constructor. The most revolutionary idea of the century is totally worthless if it cannot be communicated to others for the ultimate benefit of mankind.

2. Very often the written word is all that is available for forming opinions concerning the integrity, proficiency and credibility of an individual or company.

3. The most common deficiency in technical writers, particularly the younger ones, is in grammar and syntax, and in basic mechanics, the latter with particular reference to spelling. To a lesser degree, there is also a failure to consider the ultimate reader; e.g., in the matter of discussing or describing highly technical subjects to decision-makers with little or no technical knowledge.

Jack B. Cornett, Executive Vice President
W. R. Holway & Associates
Tulsa, Oklahoma

Engineers and scientists who are unable to communicate clearly with others frequently do not progress well in an organization and fail to impress others with their ability. They gain a reputation as fuzzy thinkers.

Ability to express one's self clearly both orally and in writing is exceedingly important. They may go together, and some training toward clear thinking for oral expression is also probably in order. However, if one must have failings -- I would prefer it in the oral area since there is frequently a chance to question their meaning and clarify their statements. There is nothing more frustrating than to have a written document which deals with the subject at hand -- but which is unclear as to the meaning of the author's explanations -- or in which the author presents the work in such a jumbled manner that his results cannot be followed.

Back about 1936 or 1937 Chemical Week made a survey and ran a series of articles on "Why Chemical Engineers Get Fired!" There were 3 predominant reasons (not necessarily in the order shown): (1) Inability to get along with other people, (2) Inability to write a clear, concise technical report, (3) Not technically capable. (The third reason was in third place.)

Burton B. Crocker, Senior Engineering Fellow
Monsanto Company
St. Louis, Missouri

Clear, precise and to-the-point written expression is a good way to save time and money for most any business (including technical reports and correspondence). Much of the success in accomplishment is attributed to this skill and for those who are ambitious, it is a "must" to be able to express ideas, thoughts, etc. clearly in written communications.

L. B. Curtis, Manager, Engineering Production
Continental Oil Company
Houston, Texas

Effective, concise written communications whether they be letters or reports will result in greater employee job security and advancement.

The ability to orally express oneself is also very important for engineers and scientists.

My comments also apply to military personnel as I am a retired Lieutenant Colonel, U.S. Army Reserve with Air Force Staff experience.

Roy E. Dahlin, P.E.
Western Institute of Light and Vision
Rancho Mirage, California

Inability to express ideas clearly in writing and speaking is the single greatest problem with graduating engineers.

Philip S. Davy, President
Davy Engineering Company
La Crosse, Wisconsin

If you have not already contacted F. A. Cleveland, Vice President of Engineering, Lockheed Aircraft Corporation, Burbank, you should do so. In my opinion, he is one of the outstanding engineers with respect to the matter of report writing. I am sure that if he could spare the time he could give you much help in this field.

Fred N. Dickerman
Lockheed-Georgia Company
Pinellas Park, Florida

Most technical writers get there by sheer luck and sometimes by hard experience. Many specifications are ambiguous and often full of conflicts. Courses should be taught by instructors with some actual knowledge of technical writing and experience; not just academic qualifications to teach. We note a large communications gap between industry needs and subjects taught.

Wallace L. Donley, President
W. L. Donley & Associates
Fresno, California

In addition to the comment in 3 above, there are two other things of import:

1. I thought I knew the English language until I worked for a Russian-born engineer. Many times I found that what was clear to me had a double meaning, was a colloquialism, or was just plain unclear in intent when viewed critically. If he had a question, he would translate it into Russian and then back into English, an ability I did not possess. Word choice can be critical.

2. Courses I have taken are structured to cover a wide range. For experience, people are asked to write on things about which they have no knowledge. Often the student attempts to cover an impressive subject. Writing should be geared to subjects the student knows well or can easily research. This means more work for the instructor than a highly structured course and evaluation is more subjective.

Robert O. Drange, Partner
Howard, Needles, Tammen & Bergendoff
Kansas City, Missouri

Most engineers and architects are almost illiterate when it comes to writing.

Charles W. Durham, President, Chairman of the Board
Henningson, Durham & Richardson
Omaha, Nebraska

My observation is that young engineers coming out of school are very poorly educated as far as writing even simple short reports is concerned. I believe there is too much emphasis in school about grammar, punctuation, etc. This cannot be ignored, but it is much more important that the student be taught how to recognize meaningful data and information and put it into a simple and clear, logical order for the person for whom the report is intended.

Report writing in an engineering curriculum should never be taught by a professor from the English department. It should only be taught by faculty members who themselves can write clear and concise reports. These teachers should know a lot about data and how to clearly present what is needed for the report.

Carl J. Eaton, Director of Research
Champion Spark Plug Company
Toledo, Ohio

Any course of this type should balance between technical communication and business communication. Too often, the latter is ignored.

Clyde Edwards, Vice President
Williams Brothers Waste Control, Inc.
Tulsa, Oklahoma

A course in technical writing as such is a waste of time. The ability to successfully communicate should be an integral part of any university course. Transference from successful communications in history of philosophy to a basically technical subject is direct. The skills are the same and the effort probably greater since the ideas are usually more complex.

W. B. Eisen
Manager of M-11 Metallurgy
Crucible, Inc.
Syracuse, New York

The importance of effective communications in any business effort or activity is well recognized. Many in the engineering and scientific fields have limited access to avenues of communication to attain favorable results in their projects and activities. Sometimes writing is the only one available as a means to communicate at many levels. Frequently managers, who must make decisions based on engineering information, are not in the engineering community, and it is important for the engineer to communicate in a way that can be understood by engineers as well as others with a diversity of interests and backgrounds. Effectiveness in communication through writing could be a major contributing factor in progress and success in engineering work. Courses to promote effective technical writing should be an important part of scientific and technical education.

William D. Elden
General Mills, Inc.
Package Foods Operations Division
Minneapolis, Minnesota

A real need, I think, is to encourage better training in the secondary school system. Is it not somewhat unreal to try to teach "technical" writing to students who cannot handle "non-technical" writing? Since this deficiency is not easily overcome, start engineering and scientific students on a writing program early in their undergraduate curricula and maintain a responsible requirement for excellence. (Some technical school faculties will need refreshers -- or training -- too.)

John C. Ellis, Manager, Vehicle Emissions Control
Shell Oil Company
Washington, D.C.

Today -- writing is absolutely essential to all scientifically trained people -- with the exception of the most brilliant -- one out of ten thousand.

Regarding content of the course -- the arbitrariness of English teachers must be kept out of the course. English is not a logically structured language -- we adopted what we chose from many roots. Thus it is still subject to selection to fit the purposes and taste of writers. Thus -- short of clarity -- nothing else should be inviolable.

Eugene A. Eschbach, Staff Scientist
Battelle Memorial Institute
Richland, Washington

Inability to write effectively is the most common shortcoming of engineers, particularly in recent years.

Courses in writing should emphasize precise writing and should not be limited to technical reports. A successful engineer must blend administrative, business and technical skills.

Norman R. Farmer, Manager
Systems Analysis Department
George G. Sharp, Inc.
Millburn, New Jersey

Without good communication skills, a scientist or engineer has limited growth. Therefore, every such person needs courses in clear technical writing. Such courses must teach how to organize subject matter and present it with low "fog index." A person who can organize his thought for writing well can organize his work activities well.

Of available books, two were helpful to me when I was a Research Division Manager, before retiring. (1) Effective Writing -- for Engineers, Managers, Scientists, H. J. Tichy. John Wiley & Sons, New York (1966); and (2) Practice Handbook in English, Easley S. Jones, D. Appleton-Century Company, New York, (1935).

Dr. Charles L. Faust
Private Consultant
Columbus, Ohio

I have endorsed, strongly herein, the idea of a course in technical writing; not so much because I believe in such a course as being invaluable, but rather because it may be the only means by which some engineers will be able to acquire any degree of acceptable writing skill. There is no substitute for a very strong background in basic English grammar in primary school, enhanced by practice and experience in writing and reading in secondary school. If a situation cannot be stated or written so that the hearer or reader can understand easily and completely, the greatest expertise in the world on the part of the speaker or writer goes for naught.

Frank F. Ford, President
Frank F. Ford & Associates
Atlanta, Georgia

Those of us in technical fields, particularly engineering, have begun to realize that our technical writing has been self-serving and as a result has not enhanced our image outside the professional community. There are few organizations that are totally technical. It becomes very important that technical people become proficient in preparing technical papers for comptrollers, accountants, lawyers, and in some cases, the general public.

Gerritt D. Fremouw, Director
Office of Facilities Engineering and Property Management
Department of Health, Education & Welfare
Washington, D.C.

Most engineers are so poor at writing a report it is almost unbelievable. Sadly, most of them don't understand how much this hinders them in their careers, and really reduces their usefulness.

Dr. David L. Fried, President
Optical Science Consultants
Yorba Linda, California

A scientist or engineer may be the most capable person from a technical standpoint, but if he does not have the ability to express himself clearly, to present his viewpoint effectively, then his good work may go for naught.

John B. Giacobbe, Vice President, Metallurgy
Superior Tube Company
Norristown, Pennsylvania

Convey the idea that no technical or administrative project is complete unless an effective, accurate, meaningful ... report is written. Writing the report is just as important as acquiring the data.

Include material on effective presentation as well -- public speaking techniques, effective use of visual aids, and how to give a good talk to a group.

Convey the idea that the writer must first be a good reader. It pays to read the classics in literature -- reading technical material alone is inadequate. Reading literature might well prove to be fun!

Dr. Lester Goodman, Branch Chief
National Institute of Health
Bethesda, Maryland

Scientists and engineers who do not have the ability to write effectively will be greatly handicapped in the furtherance of their careers, no matter how brilliant or competent they may otherwise be.

Wesley P. Goss, Chairman of the Board
Magma Copper Company
San Manuel, Arizona

Engineers can communicate with each other, but when it comes to the layman and non-technical persons, they fail --

Many times engineers read into a matter of correspondence information that is not applicalbe to the issue --

Engineers need more training in self-expression, both in writing and in speech.

W. William Graham, Jr., President
W. William Graham, Jr., Inc.
Little Rock, Arkansas

May I respectfully suggest, as it relates to my personal experience, that the lack of effective technical writing training has been a deterrent in my own management, engineering and technical development career.

In working with many scientists and engineering people in Europe and Japan it is my opinion that a greater number of them have the edge on us in this field.

In reviewing papers for many technical societies one is constantly reminded of our lack of training that would have made it possible to prepare in an organized manner a clear, concise document, understandable in detail by the profession.

It is in this area (in my opinion) the lack of professionalism in the field of technical writing is apparent and I suspect no one appreciates this lack more than the writer.

Thanks for the opportunity offered to express an opinion and a few thoughts. Please excuse the scribbling.

Dean R. Grimm, President and Chairman
Intermountain Gas Company
Boise, Idaho

Communication is closely allied to the basics of salesmanship, each dependent on the other. Need to determine before writing to whom you are writing -- to a technical person, or needing the simplified ability to express thoughts to a lay person.

Edward E. Gygax, President
Gygax Engineering & Equipment Company
St. Louis, Missouri

Technical writing is very important and one of the main ways a scientist or engineer expresses his work. A student should know how to use data banks to obtain reference material. He must know how to run an experiment or test so his results will be meaningful. He must know when the data he is getting from his experiment is meaningful or not. He must know how to organize his data and evaluate the results. He must know how to follow standard formats and keep his report concise and short as possible. The report should be free-flowing and extraneous data should be put in an appendix. Abstract should reveal pertinent data. Conclusions should be based on data contained in report.

Besides technical papers, an engineer should know how to write a specification for his test or experiment. He should also know how to write a proposal for R&D work offered by a contractor (technical and cost proposal).

Donald J. Hagemaier, Sr. Engineer and Scientist
Douglas Aircraft
Huntington Beach, California

There is no question concerning the need for a clear expression capability as a part of the technical person's portfolio.

It is important for the student and the new graduate to realize this. This will be his way, in many cases, of selling his ideas or himself to others. Basics are essential and must be mastered prior to undertaking a technical writing course.

Joseph C. Hall, Superintendent
Fabrication Shops
Union Carbide Company
Oak Ridge, Tennessee

While an undergraduate at Georgia Tech, enough English was required for a "minor" in other schools (liberal arts) in order for me to get a degree in engineering. "Technical Report Writing" and "Public Speaking" were two of the required courses. I have always been glad that they were required.

A writing course should include a "speech," an investigation, and a report of test to cover the "waterfront." Hopefully, good reference books would be included as course texts so the student could refer to them in the future.

The "GPO Style Manual" would also be an excellent course help!

William L. Hanbury, Executive Director
Federal Fire Council
Washington, D.C.

Aside from technical competence, no other single thing is of more importance than preparing an individual to express himself in written and oral form. Such a course as technical writing should be a basic part of any engineering school.

G. L. Hancock, Jr., Product Advisor
Gulf Oil Company - U.S.
Houston, Texas

Reading is an excellent way to learn writing.

Writing appears to be the main goal to many engineers and scientists -- the more you write the better the reputation. However, this is not so!!! Many writers are constantly re-inventing the wheel -- just to get their names in print. It is more important to choose effective subjects on which to perform the work. This choice is based on reading. AFTER good work has been done -- writing to report the work becomes important. Writing is an important tool of communications -- not an end in itself. The work is No. 1 -- writing No. 2 -- but before work is planned, the reading must be done.

Carlton H. Hastings
Army Materials & Mechanics Research Center
Department of the Army
Watertown, Massachsetts

Very important. In today's business world, communication to the top is by written word, not spoken.

Melvin J. Helmich
Director, Recip. Prod.
Cooper-Bessemer Company
Mt. Vernon, Ohio

Most write awful. (They would never write that and never get to the point, either.)

The Bureau of Land Management wrote a paperback, "Gobbledegook has Gotta Go." It is about as to the point as scientific writers need. The first 2/3 of it are good. The last 1/3 proves the point. Read it (the first 2/3).

Conrad R. Hilpert
Manor, Pennsylvania

As head of engineering and administrative groups over many years I have been appalled at the inability of many good engineers to prepare complete reports that reflect the real capabilities of the writers.

Ludwig C. Hoffman, Vice President
International Maritime Associates, Inc.
Washington, D.C.

These comments are made by one who has gone through the mill, and do not represent the attitude of the respondent when he was an undergraduate.

The importance of communications skills did not get across to me while a student. I intended to design bridges and was not interested in rhetoric. I think the teacher, who was a graduate student, believed that teaching rhetoric to freshman engineers was below his dignity. Teaching was merely a means of supporting himself while he pursued his program.

I was often irked by my superiors who criticized the drafts of my research reports. I hope I profited from their suggestions.

Dr. Marshall Holt (Ret.), Alcoa Research Labs
New Kinsington, Pennsylvania

Most of one's activities involve "selling": selling ideas, selling one's self, selling proposals, etc. Yet most graduates are unprepared to do this when they enter a career -- many never learn.

Too many people write in a monotonic style. They want to tell everything they know. If students can be taught to tell only what is essential and to omit everything else, then I would encourage a course in writing. The same holds true for speaking, too.

Robert E. Hufnagel, Director of Research
The Perkin-Elmer Corporation
Norwalk, Connecticut

Communications are important!

You cannot get someone to carry out your instructions unless you can communicate with him. Clarity as everyone knows is not easy to obtain. It requires the construction of a message, the punctuation, the semantics, and the length of the message.

A communication which leaves things unsaid is faulty and the reader must not be expected to be a mind reader. Every essential factor must be included and it is very important that the writer develop a good method of communication with his associates.

Horace S. Hunt, Jr., Vice President, Chicago
Engineering Division
Brown & Root, Inc.
Oak Brook, Illinois

Before any engineer or scientist can ever expect to advance, it is critical that he learn to communicate effectively. If he can do that well, there is no limit to what he can gain. But if he cannot do it, he will never make a dime. An idea, no matter how brilliant, is worthless outside of the thinker's mind if he cannot communicate effectively.

J. D. Hylton
Cameron Engineers, Inc.
Denver, Colorado

I would like to see speaking and presentations included in such a course.

Dr. Wayne H. Jens, Project Manager
The Detroit Edison Company
Detroit, Michigan

Scientists and engineers, it is believed, unconsciously violate good communication practices more than other professionals.

Had they (we) and their superiors kept the American people informed, in the layman's language, the benefits of the space program and the benefits of space-developed products to commercial industry during the past 15 years, the space program would not be in its death throes.

George W. Johnson, Manager, Quality Assurance
Aircraft Wheel & Brake Division
Goodyear Aerospace Corporation
Akron, Ohio

I disliked the courses of English grammar, writing and literature while in college. I liked technical courses in engineering and did well in these subjects.

Today, as president of an architectural and engineering company and also of an investment company, I find that the ability to write effectively is of great importance.

Clarence R. Jones, President & Board Chairman
Jones & Fellers - Architects, Engineers & Planners, Inc.
Atlanta, Georgia

In this age of instant media communication we are constantly bombarded with all sorts of written, visual and oral information. In order to make one's own thoughts easily understood, the ability to simply, yet forcefully, state your meaning is very important. The normal engineer's training does not usually prepare him to communicate properly. In the words of the former President of the University of California, Robert G. Sproul (an engineering graduate), "Us engineers don't need no English!"

William S. Kaplan, Vice President
Sexton, Fitzgerald & Kaplan, Engineers
San Francisco, California

Professor Davis: My answers to your questionnaire definitely state how important I believe the teaching of technical writing skills to be. I am of the opinion that effective written communications are the key to the progress of successful technically trained personnel.

Congratulations and my best wishes in your efforts to provide this skill to W-P engineering students. I would hope that it would be part of all undergraduate curricula.

Norman O. Kates, Vice President, Technology
Lindberg Corporation
Chicago, Illinois

It has been my experience that engineers (and manufacturing personnel) are almost uniformly very inept in expressing themselves well in writing. They generally perform much more poorly than the professionals, in my opinion. The ability to put together a cohesive, grammatically sound bit of writing is, in my opinion, of great importance in advancing in the business world!

Robert W. King, Director, Manufacturing NAO
Massey-Ferguson, Inc.
Detroit, Michigan

Most important, but don't know how effectively you can accomplish it except by study, experience, and exercise and appreciation of good reading of masters of English.

John F. Laboon (Ret.), Consulting Engineer
Pittsburgh, Pennsylvania

Apart from my remark under point 3, I would strongly emphasize the importance of an engineer's capability of clear writing. My experience from R&D in manufacturing industry is that written progress reports are most essential in assuring adequate analysis and logical thinking in carrying out an R&D task. It is thus important not only for the purpose of communicating the result to colleagues and superiors, but also for the quality of the work itself.

It seems that the course, as here suggested, should be carefully coordinated with the various technical studies and comprise guidance as to the way of writing reports in the technical fields (with apologies for my own shortcomings in the English language, which is not my native one).

Dr. Uno A. Lamm
Engineering Consultant
Hillsborough, California

Oral presentation should be a part of the course.

Allen Latham, Jr.
Haemonetics Corporation
Jamaica Plain, Massachusetts

If engineers are to influence the course of public policy in the critical years ahead, ability to write clearly is absolutely essential.

Jerome F. Lederer, Director of Safety, NASA
Adjunct Professor, USC
Laguna Hills, California

In our practice of consulting engineering, the ability to write effectively is of vital importance. Those of our professional staff who lack this ability are at a disadvantage.

George H. Leland, President
Edwards & Kelcey, Inc.
Newark, New Jersey

Generally, there is an objective or a desired result to be accomplished. There is capital-expenditure involved, and a schedule. These three goals should be covered at the very beginning of the report, and usually this is as far as top management needs to read. The various "conclusions" should be summarized at the outset.

All voluminous data can follow for anyone who would be interested in details.

Too often, you have to search through a myriad of data to find out whether the project is recommended or not. You have to go through detailed analysis before coming to a summary of capital expenditure -- you're lucky if you ever get it.

A serious mistake which is often too common is that the author of the report describes alternatives to what is supposedly his main recommendation. He leaves the true burden of decision to the client, which is

contrary to his assignment. Often, the statements given as a conclusion are subject to the reconciliation of these alternatives and leave the client in an absolute quandary.

Will J. Lessard, Executive Vice President
Main Engineers
Boston, Massachusetts

The most intelligent engineer is of no value to his fellow man unless he can communicate with others, both orally and in writing.

Richard C. LeVere
Johns-Manville
Denver, Colorado

Research - research is not complete until the results are made available in a report -- a written report (prime importance).

Production or sales - knowledge not much good unless used or given to someone else. Communication in writing is essential.

Jordan H. Levin
Location & Research Leader
USDA-ARS-North Central Region
East Lansing, Michigan

Learn to be a good engineer first, then learn to describe your work.

Howard O. Lorenzen, Superintendent, Space Systems Division
Naval Research Laboratories
Washington, D.C.

As the director of a 300-man R&D group, I finally hired a writer-editor to make my technical people "look good" in their reports and publications.

This writer-editor was able to improve reports to the extent that the technical people thought they were writing good reports. She did this in a fashion to expand the technical writers' egos and without implications of downgrading their capabilities -- either technically or in their writing.

The purpose of these remarks is to indicate that technical writing is very important. It cannot make a success of a technical person in itself, but it can considerably enhance the development and promotion of an engineer-scientist.

(For myself, I took two years of English composition and one of journalism in college. And still technical writing wasn't a snap!)

Dr. John H. Ludwig
Santa Barbara, California

Any engineering or scientific executive or supervisor can only be as effective as his ability to communicate.

Vernon G. MacKenzie (Ret.)
U.S. Public Health Service
Sanibel, Florida

After many years of supervising technical groups, I have found that those scientists and engineers who can write well normally end up in the management positions, often communicating the technical results of their subordinates. In other words, in the absence of a dual promotion ladder, just being technically excellent is not enough. Conveying the results of one's efforts in lay language is critically important.

James E. Mahoney, Director
Office of Management Planning
Office of the Secretary
Department of Health, Education & Welfare
Washington, D.C.

Every technical report should be written so that the writer and reader fully communicate now, next year, and the year after.

Raymond C. Mason, President
Mason-Johnston & Associates, Inc.
Dallas, Texas

From my answers to the above questions, you may see that I truly believe in the importance of good, clear writing for scientists and engineers. Most young folks don't seem to develop an appreciation or ability for technical writing. This severely limits one of their most important means of professional expression.

Also, and perhaps just as important, are training courses on efficient reading, or speed reading. This is a good complement to effective writing, two-way communication.

Rex R. McHail, Photogrammetrist
Bausch & Lomb
Rochester, New York

Studies, reports, criteria, results, etc. must be concluded in writing. The value of these is dependent on the ability of the writer to express himself.

Harold F. McKnight, President
McKnight Engineers, Inc.
Charlotte, North Carolina

I debated whether to put writing as an elective or required in Question 1. If it's not a good course -- forget it. It will do more harm than good.

I consider clarity, precision, and the ability to write for the reader or talk to the listener as essential qualities of communication.

There is no question in my mind that the ability to communicate well, as just described, is very important to an engineer's career. It is a necessary condition to advance beyond about the second level of management in my organization.

Dr. Brockway McMillan, Vice President
Bell Laboratories
Whippany, New Jersey

I consider it essential that technical people have the ability to write (and speak) effectively. Unfortunately, the importance of this skill to one's professional impact is not sufficiently stressed and understood. Consequently, our educational system continues to produce inexcusably large quantities of illiterate people who, upon acquiring their first job, immediately seek to rectify their deficiencies by developing a large vocabulary of "trade jargon."

I believe we need to provide our young people with:

1. Thorough instruction in the English language at an early age (before college).
2. Instruction in correct technical language and usage.
3. Training to seek and grasp the core of an issue and how to express it in crisp and concise terms.
4. Training and experience in organizaing (by outline) the presentation of an idea, issue, etc. in terms of statement, method and interpretation.
5. Training in translating the outline into written drafts.
6. Direct experience in all the above, and through editing each other's work.

Dr. Robert V. Meghreblian
Director of Technology
Cabot Corporation
Boston, Massachusetts

Dear Professor Davis: Your survey hits a nerve. Nothing is more important in the professional engineering world today than the ability to communicate. I personally think one course in professional writing will not satisfy the problem, but making it mandatory and insisting on professional excellence is better than not having it at all. What we really need, however, is insisting that engineers and for that matter, other professional people, learn to write and express themselves clearly, precisely, and accurately in their early years. This should start in grade school and high school and be actively encouraged by teaching staffs through their college and university work.

Technical writing or teaching ability in expression cannot be treated as a separate subject. Clarity in expression, and I include both speaking and writing, should be insisted upon by the teaching fraternity and made a requirement for graduation.

Although you don't ask about it, a foreign language capability in today's world, at least in our business, is almost as important.

You may use my comments as you see fit and I wish you success in your endeavor to improve communications skills in our technically trained people.

Dr. Gordon H. Millar, Vice Pres. of Engineering
Deere & Company
Moline, Illinois

English academic sense not essential. Engineering report and technical writing is essential. Technical writing develops clearer and deeper thinking. So also does expert witnessing.

Charles V. Millikan, Petroleum Engineering
Consultant
Tulsa, Oklahoma

Past experience indicates that the major deficiency in all engineering courses is the lack of knowledge of the basic English language. Too many reports are based upon the acquisition and use of engineering "buzz words" in a confusing organization, including repetition and superfluous statements in poorly organized reporting. Would suggest that all engineers engaged in writing employ a standard handbook of English and, of course, the dictionary.

James C. Mitchell, Environmental Scientist
Geoscience, Division of Geosource
Long Beach, California

The format used by the U.S. Army -- (placed in commercial perspective) in the early 1950's — was/is the best method that I have found to prepare effective written communications.

Edward A. Moy, President
Edward A. Moy Consulting/Electrical Engineers, Inc.
Woodbury, New Jersey

Have retired twice; once from the Navy after 37 years, then from industry after 12 more. Now on six boards of directors, industrial and financial, four boards, educational and civic. I have found clarity of expression and ability to convey facts simply and effectively of absolute importance to success in understanding in all these endeavors.

Rear Admiral Albert G. Mumma, USN Ret
Short Hills, New Jersey

I can only repeat, the job (project) cannot be completed until it has been transmitted to someone else. The more clearly and concisely the information is transmitted -- the better able the recipient will be to understand and accept the findings.

Raymond N. Nee
The American Society of Mechanical Engineers
United Engineering Center
New York, N.Y.

Increased information which flows to all of us -- as a result of the revolution in communication -- significantly increases the importance of concise lucid writing. That writing which fails such a test will not communicate because it will be de-selected in favor of writing which does.

Ralph L. Neubert, Director, Strategic Planning
Monsanto Company
St. Louis, Missouri

The most important things that the student should learn are sensitivity to written communication; the value of written communication; the tools of written communication; and examples.

Perhaps a good way to teach the course would be to include a host of alternate ways to achieve written communication, showing which is best, and why. Learning to be brief is also important.

Joseph H. Newman, Senior Vice President
Tishman Research Company
New York, N.Y.

The primary duty of most engineers in a large organization is to write a report. This report is normally forwarded through the chain of command to the appropriate level of decision. The validity of the decision is in large measure determined by the adequacy of the report.

Brig Gen Wayne S. Nichols, Division Engineer
Ohio River Division
Cincinnati, Ohio

I believe that the ability to write and speak effectively will also help in developing leadership and personal confidence in the face of critical professional competition.

P.S. Thought you would like to know that at age 81, I'm still interested.

John C. Niedermair, Sr.
Naval Architect
Stone Harbor, New Jersey

The great hangup, it seems to me, is the fear of violating the principles of grammar and style that we were taught (but never fully understood) in our English courses. These are important and do contribute to the effectiveness of technical writing, but tend to be stumbling blocks to engineers. The biggest problem is to overcome the reluctance to write which stems from fear of "violating" the high school English rules. The emphasis should be on organization and clarity of expression -- the rest will follow. To a large degree, elegance in expression evolved from a pursuit of those objectives.

Eugene F. O'Neill, Executive Director,
Toll Transmission Division
Bell Telephone Laboratories
Holmdel, New Jersey

My experience over the last 18 years has been as Manager of Standards for ITT Grinnell Corporation and more recently as an independent consultant to smaller companies, working with them on their problems in complying with standards, specifications, and codes.

Much of this time has been spent in applying the requirements of standards and specifications, such as ANSI, ASTM, Federal and MIL to specific products and processes and writing the internal instructions necessary to carry out these requirements within a specific company.

During this time, I have seen them applied over a much wider area and I have seen these requirements become more detailed and restrictive. Unfortunately the statements by which these requirements are expressed have become increasingly obscure and the exact intent increasingly difficult to determine. These requirements have been originated by dedicated and technically competent people, but these groups have frequently been lacking in the ability to express themselves in a clear, concise and unambiguous manner. Thus many manhours have been wasted trying to puzzle out their exact intent and many costly delays and misunderstandings have resulted. With the trend to apply more standards, specifications and codes to more engineering and industrial activities, good technical writing will be a necessity or chaos will be the result.

Charles E. Otis
Charles E. Otis & Associates
Warwick, Rhode Island

In technical fields above the lowest levels, one seldom advances solely because of technical expertise. The ability to express ideas clearly is the deciding factor. The inability to write a long sentence correctly is the most common failing.

Robert E. Philleo
Office, Chief of Engineers
Department of the Army
Washington, D.C.

Clear writing issues from clear thinking. The latter cannot be taught in the writing course alone. Nonetheless, that course is one of the occasions when the student must address the difficult self-discipline of straightening up his head. I think much can be accomplished by devoting at least one class a week (one out of three) to seminar discussion of the topic of a writing assignment with the object of distinguishing the big questions from the little ones and organizing the points on a logic tree.

Your questionnaire is obviously addressed to a practicing engineer or scientist. It is here answered by an editor.

Dr. Gerard Piel, Publisher
Scientific American
New York, N.Y.

Most engineers, I've found, are poor at expressing themselves in words and in writing. Such a course should be very beneficial.

Richard J. Proctor, Chief Geologist
The Metropolitan Water District of Southern California
Los Angeles, California

In my opinion, ability to speak clearly in public is a parallel requirement to writing.

George S. Rawlins, Vice Chairman of the Board
J. N. Pease Associates
Charlotte, North Carolina

The questionnaire addresses the subject of written communications but omits dealing with the equally important subject of oral communications. I suggest the course be expanded to include both.

Eugene D. Reed, Executive Director
Bell Telephone Laboratories
Whippany, New Jersey

I believe writing ability is of the utmost importance to engineers and scientists.

Dr. George R. Rich, Senior Vice President
Charles T. Main, Inc.
Wellesley Hills, Massachsetts

The vast majority of engineers and scientists do not communicate effectively, either verbally or in writing; hence, courses in both speaking and writing on technical subjects would make new graduates more effective in their professions. I think our society needs the input of skilled professionals into our legislative processes as one example, where the ability to talk

to your technical peers is not enough. We have to be able to talk effectively to the technically unskilled to put our expertise to work for the good of our society. One important thing to stress is to avoid "jargonizing" when writing or talking to the public -- it is also a good thing to avoid it in technical writing for communications with other professionals.

Many engineers do not write as easily as they speak, nor do they use the same vocabulary in writing as in speaking, and the result is usually boring for the reader!

Robert E. Roberts, President
Fred T. Roberts & Company
Wilton, Connecticut

The ability to write effectively is critically important in a professional career. Engineers are notoriously ineffective in communicating their ideas to those who must act on them. Therefore, training, practice, and extensive reading (including reading of non-technical literature) should begin early in a professional career and should continue.

There is no need for an engineer to be capable of writing a novel or a play. He should, however, be able to write letters and reports of high quality which are both understandable and convincing.

Maj Gen Willard Roper, USA (Ret)
Metcalf & Eddy, Ltd.
Bangkok, Thailand

All scientific writing and engineering reports require brevity and clarity of thought. The ability to express the idea with the minimum of words and the minimum of confusion is a very desirable talent.

It is important to realize that scientific writing and specifications may become legal documents and they may require justification in court. A slight redundancy can change the meaning of a statement.

Robert J. Salinger, Chief Engineer
C. F. Murphy Associates
Chicago, Illinois

Communication is all-important to success of any project. It is critical to personal success. In operating labs, sales, service, research -- I have urged my people to take public speaking and writing techniques.

Too little time is spent at the college level in writing and speaking.

Joseph S. Schumacher
Foundry Technical Director
International Minerals & Chemical Corporation
Libertyville, Illinois

Ability to write and communicate is a key factor in progress into management.

Robert E. Sessions, President
General Electric Circuit Breakers, Inc.
Palmer, Puerto Rico

Communication to others is the only way we have of making known our thoughts, our needs, etc.

Communication is mainly by two methods: written or oral. Therefore, both written and oral skills are most important.

In addition to the items noted under #3, I might note that report format is important and arrangement of contents.

° Format - we all initially judge a person or package, etc. by its appearance. Easily readable, attractive appearance, nicely arranged report pages help set the stage for a more receptive reading of your report.

° Arrangement - Often a summary of findings and conclusions with a brief discussion is very helpful at the beginning of a report.

° Tell the reader what you are going to say (what report covers and how it is presented). Tell him what you have done and then summarize. The above process can be done without being repetitious.

° Lastly -- keep in mind who your audience is or may be. This can affect the style and detail of the report.

Roland L. Sharpe, Vice President
Engineering Decision Analysis Company
Palo Alto, California

Agreements and contracts are becoming more important. Many of these are written by technical people -- then reviewed by attorneys for legal requirements.

Biggest emphasis should be on proper organization with minimum words.

Lloyd O. Shorter
Manager of Systems Engineering
Delmarva Power & Light Company
Wilmington, Delaware

Too many qualified men don't know how to communicate and how to assemble their thoughts in progression. Thoughts must be presented in an orderly form, starting with the basic problem and developing to a conclusion.

At times I find too much verbiage appears between the premise and the conclusion and the reader has to wade through endless discussion to arrive at the answer. Judgment becomes a factor as to who will be reading the paper and whether his time warrants detailed technical writing in the body of the paper.

Sidney A. Silver, P.E.
Silver, Schwartz & Associates
Washington, D,C,

The average engineer or scientist says too much, in too much detail and "talks down" or "teaches" too much. Writing to management requires simple layman's presentation of technical information with recognition of the high level of audience intelligence and the limited need for technical details.

E. Ralph Sims, Jr., President
E. Ralph Sims, Jr. & Associates, Inc.
Lancaster, Ohio

In my experience, I have found that technical writing, a course I did not have in college, would have been a tremendous asset to me. The primary trouble I have experienced is that I did not know the method of presenting material so persons, not directly associated with my field, could understand and logically follow.

Metz K. Skelton
Skelton & Associates, Inc.
Kennett, Missouri

The ability to communicate is one of those areas often neglected in scientific and engineering education. We need better English courses in most engineering educational activities.

Herschel A. Sosnin, Consulting Engineer
Jenkintown, Pennsylvania

There is a place for scientists/engineers who can communicate best in numbers and formulas. There are needs too for specialists in communications who can interpret what the non-writers need to communicate. Not everyone needs to be an expert communicator but it is usually useful. A good R&D team would have at least one expert communicator in the group.

Frank Y. Speight, Manager, Safety & Health
American Welding Society
Miami, Florida

The most important: presenting a course of reading in good literature, particularly on good scientific writing.

Philip Sporn, Consultant
New York, N.Y.

Although it has always been generally agreed that engineers are poor technical writers, there are a few who write exceptionally well. I feel that these few are not necessarily products of exceptional training, but more likely are apt pupils for the limited exposure they have had to this type training. Grammar, syntax, and composition are not receiving adequate

attention in today's elementary and high schools. The tendency for college curricula in specialized fields like engineering and the sciences to expose the student to a maximum of technical subject matter at the expense of "less important" courses like English composition, etc. further compounds the problem.

Stephen D. Stoddard
Ceramics Section Leader
University of California (Los Alamos Scientific Laboratories)
Los Alamos, New Mexico

The ability to communicate effectively in writing is essential to the professional development of most scientists and engineers.

James J. Stout
Division of Licensed Projects
Federal Power Commission
Arlington, Virginia

Engineers and scientists (E&S) are known poor writers, and yet, more than other fields, E&S need the most to communicate his or her ideas to others because of the nature of responsibilities. Training in technical writing is a must for fulfilling the career goal for anyone who is not willing to be the tool of others.

William K. Y. Tao, President
William Tao & Associates
St. Louis, Missouri

Dear Professor Davis: I am firmly a believer in an engineer having adequate ability to speak and write properly; either in military or civilian style. I am most happy to state that more consideration should be given to these areas during the educational process.

Any scientist preparing technical papers, unless he or she has an editor, must know and understand proper report writing methods, style, and effectiveness of a presentation.

Any engineer who wishes to enter middle management, whether in technical or general engineering field, should be able to speak, dictate, or write effectively. Another quality of an engineer should be to speak extemporaneously to an audience -- whether as a supervisor or nct -- to an engineering or non-engineering audience. An unannounced, five-minute dissertation on any subject is a valuable training activity.

Hanford Thayer, P.E.
Consulting Engineer
Tudor Engineering Company
Seattle, Washington

Too many courses emphasize the niceties of writing rather than the importance of concisely presenting the facts of the situation -- be it a field construction inspection report, a research project, or review comments for plans and specifications.

Lloyd B. Underwood, Division Geologist
Missouri River Division
U. S. Army, Corps of Engineers
Omaha, Nebraska

The ability to write effectively, for scientists and engineers, is very important.

Dr. Kent R. Van Horn, Vice Pres. of Research & Development
Alcoa Company of America
Pittsburgh, Pennsylvania

It concerns me that there is even any question or debate about the merits of technical writing course(s) as a requirement in scientific and engineering curricula.

It might well be combined with verbal communication since both are essential and thought organization and conveyance are at the core of both.

Thomas J. Vogenthaler, Director
Colorado Energy Resources Institute
Golden, Colorado

Without communication, an engineer is nothing but a technician.

Henry M. von Oesen, President
Henry von Oesen & Associates, Inc.
Wilmington, North Carolina

I am delighted that you are addressing this problem; it's one of my favorite themes.

My selection of replies to the above questions should not be interpreted as proposing that uniform writing requirements be placed on all student engineers. In my opinion, interest in writing is a characteristic of the individual. Certainly all engineers must have some knowledge of writing above the high school level if they are to be engineers at all. Those engineering students who have some interest in writing should be given as much instruction as the already heavily laden curriculum permits. It might well be wasted effort to attempt to raise all candidate engineers to the level of even fair technical writers.

Certainly in the defense industry where the preparation of proposals, specifications and reports is a critical element of engineering work, the ability to delineate unambiguous meanings is an essential engineering skill.

I studied journalism while preparing myself for a career in electrical engineering, and in industry, I found that my ability to write engineering and administrative material was more needed than whatever engineering skill I possessed.

Alfred S. Wall, Manager
RCA
Moorestown, New Jersey

Write or talk at a level that the audience can absorb material.

Charles W. Ward, Jr., Foundry Consultant
Benjamin Harris & Company
Louisville, Kentucky

I have been on the ANS Program Committee and have been active in my own company in preparing many kinds of reports and specifications. Currently I am in charge of Nuclear Quality Assurance.

During the period of time from 1960, I have noted a steady deterioration in the quality of the writing capability of engineering graduates. I believe that a program like that carried on by the University of California at Berkeley's Engineering Department is still vitally needed. Their senior engineering students had to prepare two lab reports a week. These reports were graded by the various technical disciplines as well as by the English Department. It was rigorous training in preparing, organizing and publishing technical reports.

Louis J. Weidner, Jr., Senior Nuclear Engineer
Los Angeles Department of Water & Power
Los Angeles, California

For any management roles -- the ability to communicate well in writing is essential -- he who can do it is blessed! -- he who can't is cursed. If you want to use me as a reference, please do!

Robert M. White
National Oceanic & Atmospheric Administration
Department of Commerce
Rockville, Maryland

Communication of ideas and control of the idea in a business environment is of critical value in technical endeavors.

A good secretary can take care of grammar and mechanics, but the person with the technical competence must clarify and present the facts in a manner which others can understand and use.

Charles W. Wilson, Manager of Marine Sales
Babcock & Wilcox Company
New York, N.Y.

It is imperative that engineers be able to write effectively. Written reports are often their only communication with senior management. A superior technical effort can be wasted if it is not clearly reported. Use of poor grammar and punctuation will cast doubt upon the writer's technical competence.

One of my pet peeves is having to correct the grammar in a subordinate's paper or report.

Dr. Richard K. Wilson, Vice President,
Production
North American Rockwell
Pittsburgh, Pennsylvania

I believe that most people would agree that communications is always a major problem. It can never be done too well. Transmitting technical information, especially from technical to non-technical people, is very important and difficult to do. Many engineers do poorly in this area and suffer because of it. They don't appreciate the need for selling what they have to say in a clear, concise, understandable sort of way.

Gilbert R. Wolter, Vice President, Research
& Engineering
Sunbeam Appliance Company
Oakbrook, Illinois

In my long experience and association with scientists and engineers, I can't remember a single incident of anyone advancing to a position of significance who could not express himself effectively on paper.

Edward R. Zebrowski, Manager
Rohm & Haas Company
Philadelphia, Pennsylvania

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A questionnaire was sent to prominent successful engineers to determine their experience with technical writing, their opinions about its importance to an engineer, and their opinions about its place in the engineering curriculum. A surprising 73.8 percent (245 of those surveyed) responded. The replies indicate that the respondents spend 24 percent of their time writing, that the writing that they do is very important to their positions, and that the ability to write effectively has helped them in their own advancement. They spend

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31 percent of their time working with material written by others, are acutely conscious of the need for effective written communications, and find fault with many of the written communications with which they deal. They indicate that the ability to write is usually important or critical when a man is considered for advancement.

80.5 percent of the respondents feel that technical writing should be required of all engineering students and 16 percent feel that it should be an elective with all students encouraged to take it. They feel that the main emphasis in such courses should be on teaching students to analyze a writing situation and produce a clear, direct, logically developed communication to meet the reader's needs without burdening him with extraneous material or long-winded verbiage. Emphasis should be on the need for clarity and ready comprehensibility.

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